Appendix J – Workshop and Meeting Summaries (Included Electronically)

A workshop was held in the Waukesha Water Utility large conference room at 9:00am on November 10, 2016 to discuss the Great Lakes Water Supply Program High-Level Cost Validation.

The attendees are listed on the attached sign-in sheet. The agenda, presentation materials and handouts are attached.

Action Item		Action By	Due Date/Deliverable	Completed
1.	Utilize most current national ENR not the regional adjustment for estimating 2018 costs.	TRB	11/28/2016	Y
2.	Schedule meeting to discuss revised memorandum with WWU	NBS	11/28/2016	Y
3.	Prepare executive summary of memorandum for December 15, 2016 Commission meeting	NBS / CMR	12/06/2016	
4.	Obtain incurred costs from the Application process and actual distribution work that has been done to be included as part of total Program cost development.	NBS / CMR	12/09/2016	

1) **Welcome**
   a) After the introductions of the team members working on the High-Level Cost Validation, the workshop objectives work outlined as follows:
      i) Establish the purpose of High-Level Cost Opinion
      ii) Understand Audience to which the Cost Opinion will be communicated
      iii) Understand what has been communicated under Great Lakes Diversion Application
      iv) Establish process for updating Cost Opinion
      v) Definition of Costs

2) **Great Lakes Water Supply Program**
   a) The anticipated program elements were discussed as a group to confirm that everyone was working with the same assumptions. It was determined that the major project elements include the following items:
      i) Water supply pump stations
      ii) Finished water pipeline
      iii) Finished water storage
      iv) Chemical facilities
      v) WWTP improvements
      vi) Treated clean water pump station
      vii) Treated clean water return flow pipeline
      viii) Outfall

b) The anticipated schedule for the program was also discussed as it relates to the methodology that will be used in determining the price of the projects associated with the Program. Prices for the project elements will be cost adjusted to reflect the price at the mid-point of the project schedule
c) Permitting and Legal Administrations were discussed as they relate to the Total Program Costs. Anticipated Costs for permitting and legal administration will be estimated based on the information we have and the experience that both the Utility and our team members have had working with the various regulatory agencies that will be reviewing and permitting the Program.
d) It was agreed upon that mark-ups and contingencies will be used as outlined in the Association of the Advancement of Cost Engineering (AACE) recommended practices for a Class 5 estimate, which is completed in the early concept phase of the Program.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the workshop.

Waukesha Water Utility
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Great Lakes Water Supply Program

High-Level Program Cost Validation Workshop (W-5)
Sign-in Sheet
November 10, 2016

No.	Name	Company	Initial
1	Daniel Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	
3	Donna Scholl	Waukesha Water Utility	
4	Robert Zellmer	Baker Tilly	
5	Paul Vogel	Greeley and Hansen	
6	Nicole Spieles	Greeley and Hansen	
7	Katie Richardson	Greeley and Hansen	
8	Lee Melcher	Greeley and Hansen	
9	Tony Myers	CH2M	
10	Brent Brown	CH2M	
11	Bill Stannard	Raftelis	
12	Joe Crea	Raftelis	
13			

High-Level Program Cost Validation (Workshop No. 5) Agenda
November 10, 2016

Time	Topic
09:00 am	Welcome • Introductions • Agenda Overview (Handout) • Workshop Objectives
09:15 am	Great Lakes Water Supply Program • Anticipated Program Elements • Anticipated Schedule • Permitting, Legal Administration • Markups and Contingency
09:45 am	Great Lakes Diversion Application Cost Opinion • Relevant Items • Escalation
10:15 am	Methodology for Preparing Cost Opinions
10:45 am	Break
10:55 am	Draft Level 5 Cost Opinion
11:30 am	Alternative Funding Evaluation
11:45 am	Summary & Wrap up
12:00 pm	Adjourn

Great Lakes Water Supply Program
Workshop No. 5

High-Level Program Cost Validation

November 10, 2016

Greeley and Hansen

Waukesha Water Utility
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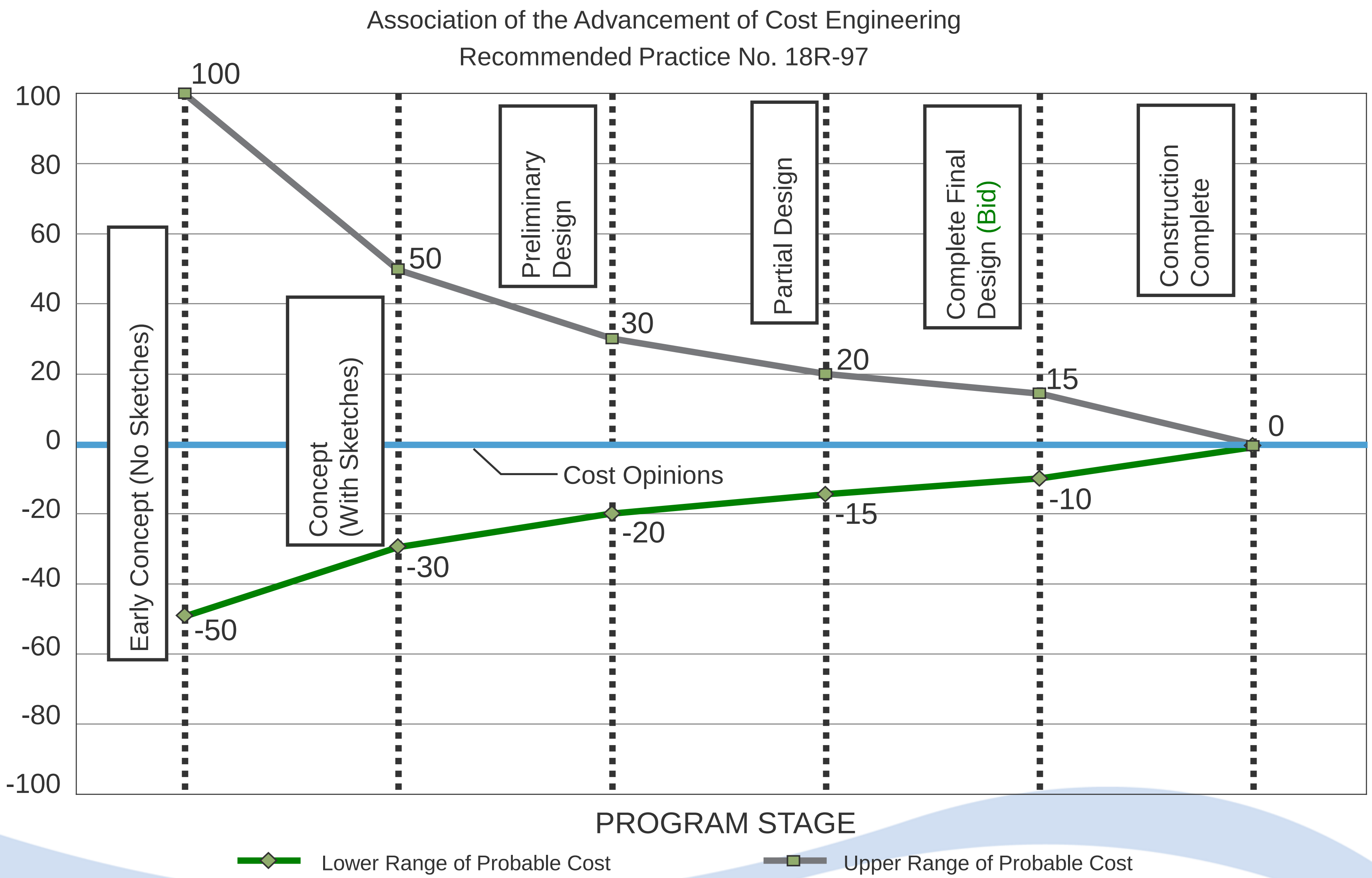
Opening Remarks

- Introductions
- Recap of General Workshop Behaviors
- Ground Rules
  - Role of Facilitator

Agenda Overview

- Welcome
- Great Lakes Water Supply Program
- Great Lakes Diversion Application Cost Opinion
- Methodology for Preparing Cost Opinions
- Draft Class 5 Cost Opinion
- Alternative Funding Evaluation
- Summary Wrap-Up

Beginning with the End in Mind



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Ground Rules

- Success is the responsibility of all
- Everyone shares the responsibility for success
- Everyone must participate fully to the extent of their expertise
- We agree to speak up honestly and with candor
- Disagreements are with opinions or issues, and have basis in fact, not with personalities

Ground Rules (continued)

- Listen attentively and respectfully to others
- Participate conscientiously and read material prior to workshops
- Understanding is our objective, but consensus is not required
- Adhere to these ground rules and hold each other accountable

Role of the Facilitator

- Remain neutral and objective
- Expedite adherence to agenda and schedule
- Ensure an equal opportunity to be heard
- Keep group focused on discussion as planned, place items in "parking lot"
- Remind all of ground rules
- Negotiate changes in agenda, schedule, or procedure
- Manage discussion, sequence speakers, and exercise leadership

Workshop Objectives

- Establish the purpose of High-Level Cost Opinion
- Understand Audience to which the Cost Opinion will be communicated
- Understand what has been communicated under Great Lakes Diversion Application
- Establish process for updating Cost Opinion
- Definition of Costs

Definition of Costs

- Construction
- Operation and Maintenance
- Project
- Capital
- Total Program

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Great Lakes Water Supply Program

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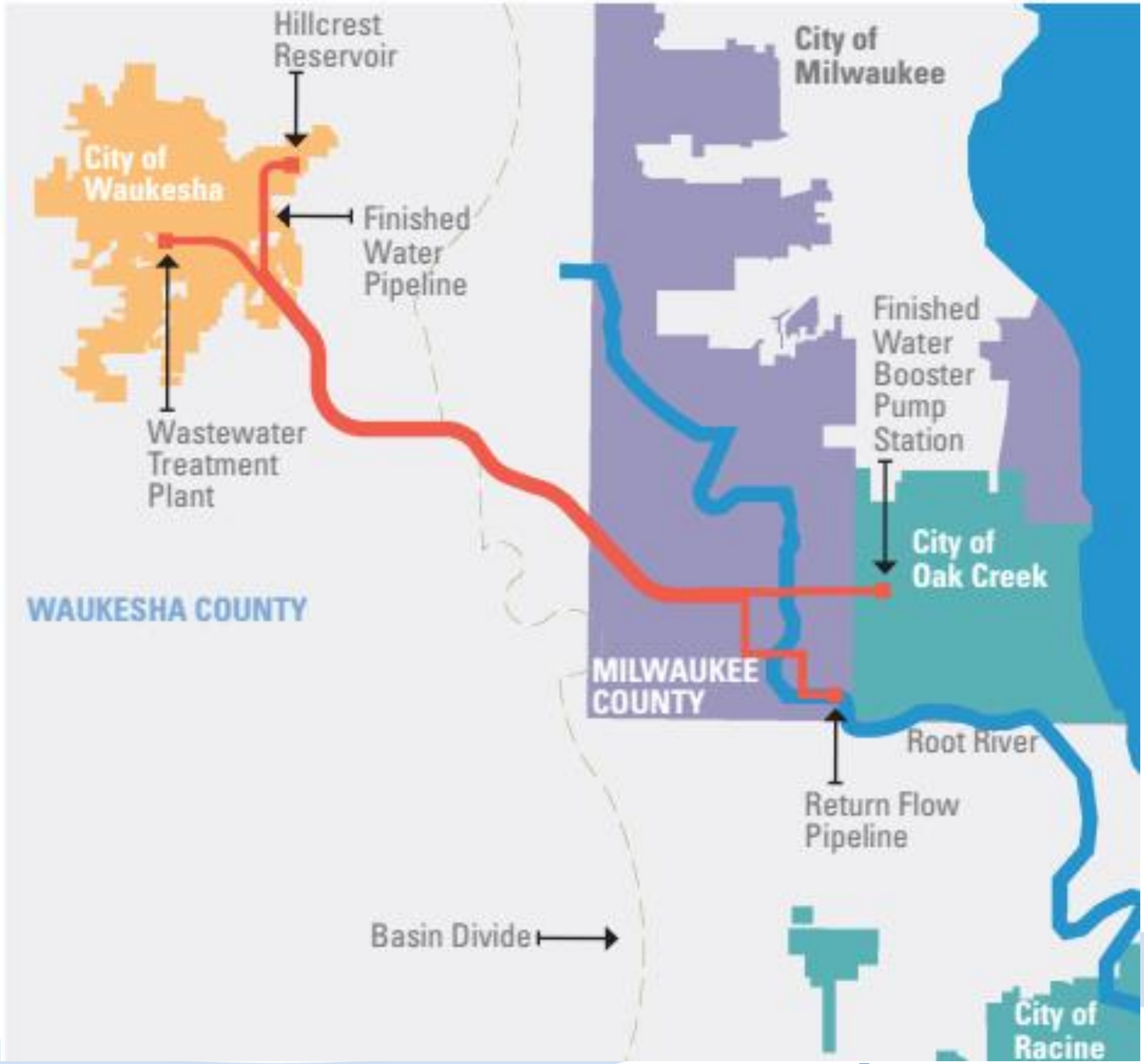
Great Lakes Water Supply Program



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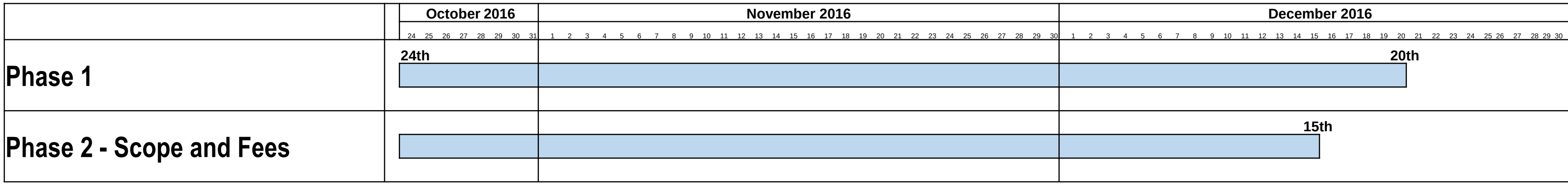
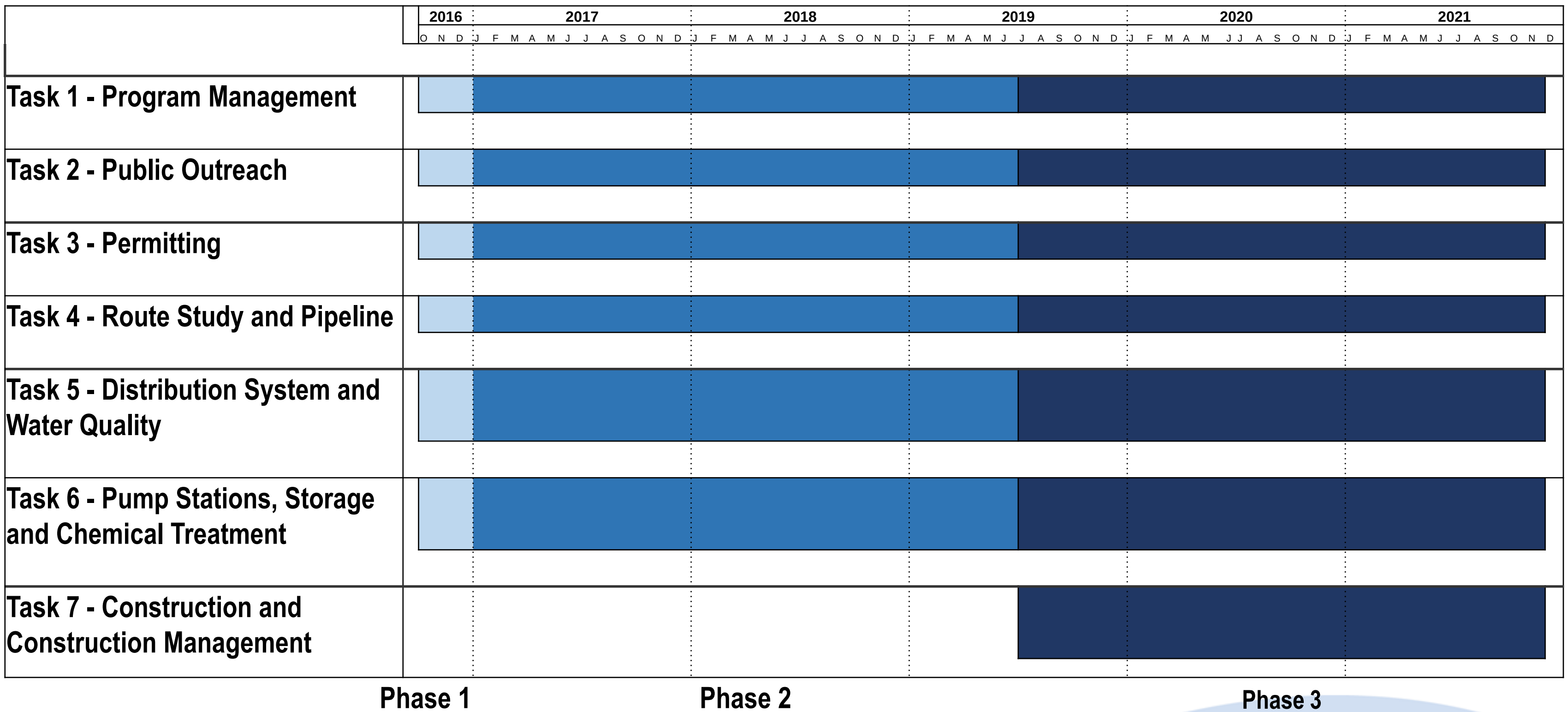
Program Schedule Overview





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Anticipated Program Elements

1. Water Connection at Oak Creek
2. Water Booster Pump Station
3. Water Reservoir
4. Water Pipeline and Vaults
5. Chemical Feed Facilities
6. Water Connections at Waukesha
7. Waukesha Water Distribution System Improvements

Anticipated Program Elements (Continued)

8. Return Flow Pump Station
9. Return Flow Pipeline and Vaults
10. Outlet and Facilities at Root River (Wetlands / Aeration / Thermal)
11. Necessary WWTP Improvements (Exclusive of Pump Station)
12. Other Program Elements

Great Lakes Diversion Application Cost Opinion

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Great Lakes Diversion Application Cost Opinion

Alternative 2 - Lake Michigan Supply

From Oak Creek. Return to Root River.

Captial Cost

	Quantity	Unit Cost	Total
Lake Michigan Supply Pump Station			
one PS @ 16.7 mgd and 210 psi	1	$ 8,830,125	$ 8,831,000
Lake Michigan Supply Pipeline			
20 miles of 30"	105,600	$ 408.00	$ 43,085,000
Return Pump Station and Pipeline			
one PS @ 16.7 mgd and 210 psi	1	$ 3,700,000	$ 3,700,000
19 miles of 30"	100,320	$ 457.00	$ 45,847,000
Distribution System Improvements			
5 mi of 24" pipes	24,800	$ 206	$ 5,109,000
Subtotal			**$ 106,572,000**
3% markup for Bonds & Insurance			$3,198,000
5% markup for Mob/Demob			$5,329,000
8% markup for Contractors Overhead			$9,208,000
4% markup for Contractors profit			$4,604,000
25% Contingency			$32,228,000
Subtotal Markups and Contingency			**$ 54,567,000**
Total Project Construction Costs			**$ 161,139,000**
8% allowance for engineering and design			$12,892,000
12% allowance for permitting, legal and admin.			$19,337,000
8% allowance for engr services during construction			$12,892,000
Subtotal Other Project Costs			**$45,121,000**
TOTAL PROJECT CAPITAL COST			**$ 206,260,000**

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Great Lakes Diversion Application Cost Opinion

- Bases for Permit Application Program Cost Opinion
- Discussion

Methodology for Preparing Cost Opinion

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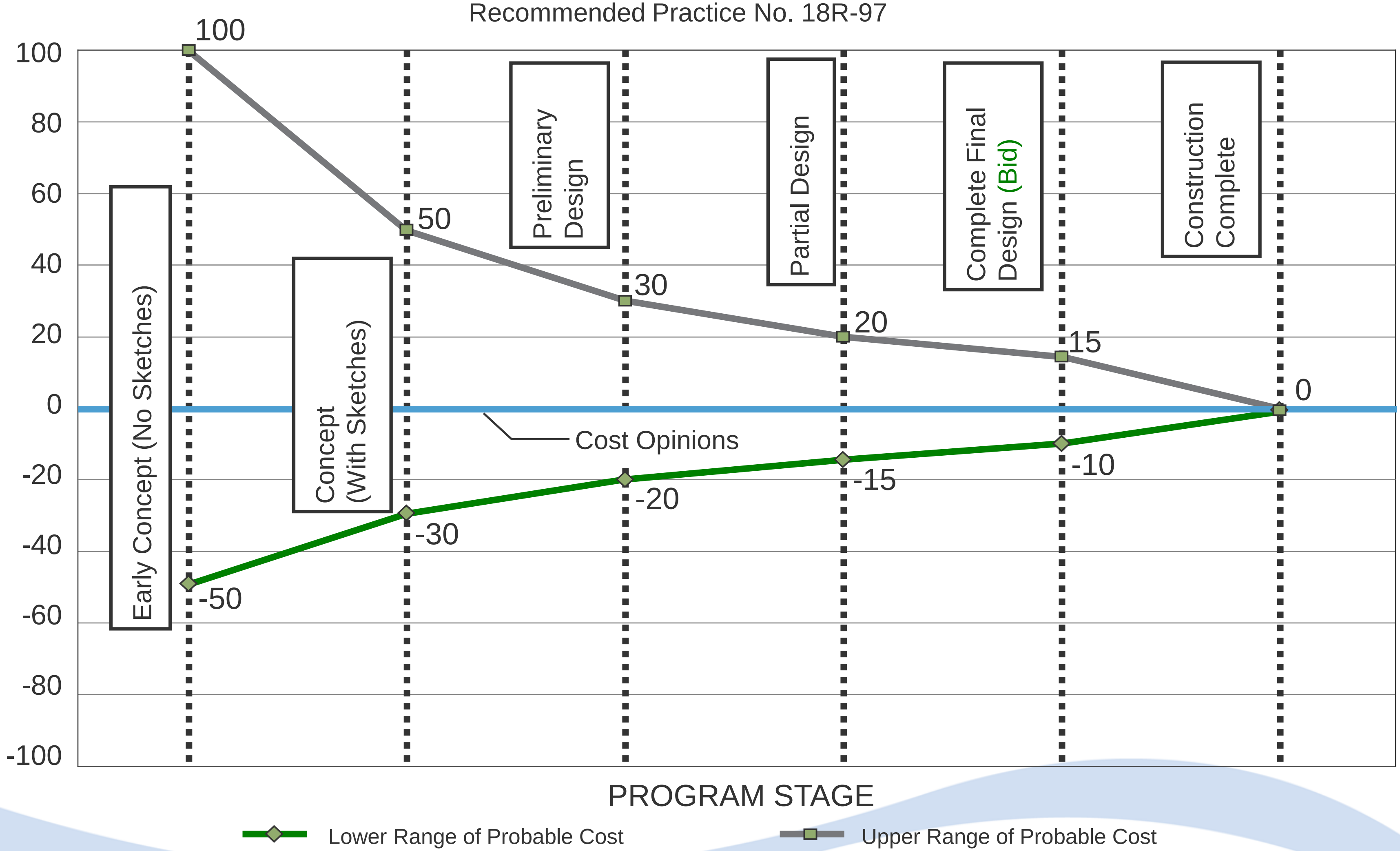
Overview

- Comparative vs Conceptual Opinions
- Conceptual Assumptions
- Accuracy of Cost Opinions
- Program Cost Database

Definition of Cost Accuracy

Association of the Advancement of Cost Engineering
Recommended Practice No. 18R-97



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Types of Cost Opinions

- Comparative Cost Opinions
  - Used to compare alternatives
  - Do not include common elements (site work, roads, landscaping, etc…)
  - Present Worth of Capital and O&M Costs
- Conceptual Design Capital Cost Opinions
  - Used for Budgetary Planning of Recommended Alternative
  - Does include opinions for common elements

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Comparative Cost Opinions

- Capital
  - Unit costs per lineal foot for pipelines
  - Unit costs per square foot or volume for process tankage and building structures
  - Vendor Cost Opinions for Major Equipment
  - Appropriate Contingency Costs for piping, mechanical, electrical, instrumentation, etc…

Comparative Cost Opinions (Continued)

- O&M
  - 3% of Capital Cost for process tankage and structures
  - 3% of Capital Cost for major equipment
  - 5% for rotating equipment
  - Power usage for identified large motors
  - Current cost for power ($/kwh)
  - Chemical usage
  - Current chemical costs

Conceptual Design Capital Cost Opinions

- Capital
  - Limited Quantity Take-offs for Demolition and Removal with prices for Means
  - Unit costs per lineal foot for pipelines
  - Unit costs per square foot or volume for process tankage and building structures; or,
  - Limited Quantity Take-offs with Material Prices from vendors or Means
  - Updated Vendor Cost Opinions for Major Equipment
  - Limited Quantity Take-offs with prices from vendors or Means for piping, mechanical, electrical, instrumentation, etc…

Conceptual Design Capital Cost Opinions (Continued)

- Capital
  - Limited Quantity Take-offs for common elements (site work, roads, landscaping, etc.) with prices from vendors or Means
  - Appropriate Contingency Costs for undefined elements
  - Appropriate Contingency Costs for Waukesha
  - Appropriate Contingency Costs for Administration, Design Services, Contractor's OH&P, etc…

Conceptual Cost Opinion Details and Assumptions

- Notes
  - Value in parenthesis is just typical values but will vary based on size and complexity of the project and will be selected during the workshop process.
  - The escalation should be linked to a specific ENR Cost Index month or year and should also show the projected mid-point of construction. This way if a project is delayed or there is a significant increase in the ENR Cost Index, the total escalation can be adjusted accordingly.

Conceptual Cost Opinion Details and Assumptions (Continued)

Basis of Opinion	• **Project description, scope outline, and listing of major assumptions including schedule and cost escalation factor as well as any significant changes in the designs or costs.**
Direct Costs Opinion	• **Major equipment listed and priced using material/equipment quotes, man-hours, established labor rates.** • **Where measurable or roughly quantifiable, standard unit costs (pipe, railing, paving, etc.).** • **Cost per LF/SF (based on previous projects) for un-designed structures.** • **Spreadsheet format is acceptable for flexibility.** • **Hard cost (construction costs).** • **Organize costs by Program Elements**

Conceptual Cost Opinion Details and Assumptions (Continued)

Indirect Costs * Note: multipliers are compounding not additive	• Scope Development Contingency • General Conditions • Payment Performance Bonds • Overhead and Profit • Construction Escalation (based on ENR Cost index at Time of Cost Opinion)
Allowances	• Construction allowances
Probable Total Construction Cost	
Change Orders	• Potential Change Orders

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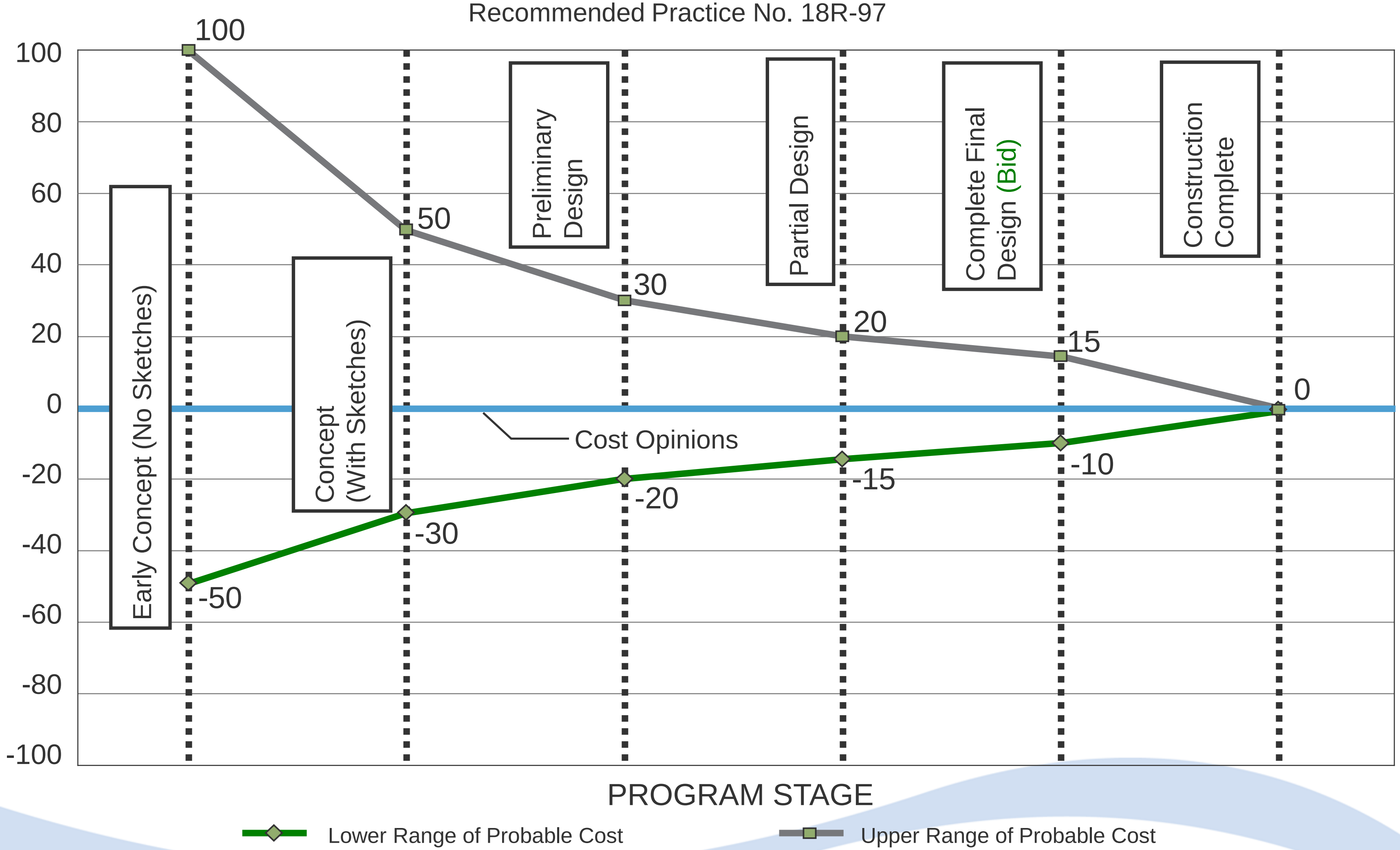
Conceptual Cost Opinion Details and Assumptions (Continued)

Soft Costs (% of total construction cost)	• Program Management • Public Outreach and Communications • Environmental Impact Statement/Permitting • Engineering/Architecture/Survey • Land Acquisition and Easements • Construction Management • Fixed Asset Survey • Other Professional Fees • Soft Cost Contingency

Definition of Cost Accuracy

Association of the Advancement of Cost Engineering
Recommended Practice No. 18R-97



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Project Cost Database

- Developed for common elements
- Ensures same costing/sources when comparing projects
- Approach:
  - Gather sources
  - Evaluate applicability
  - Create database

Unit Sources

- Existing Waukesha Database
- Historical Bid Database
- Means/Generic cost curves
- Vendor quotes
- Unit costs from other projects

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Break – *10 Minutes*

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Class 5 Level Cost Opinion

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Program Schedule Overview (continued)

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Assumptions

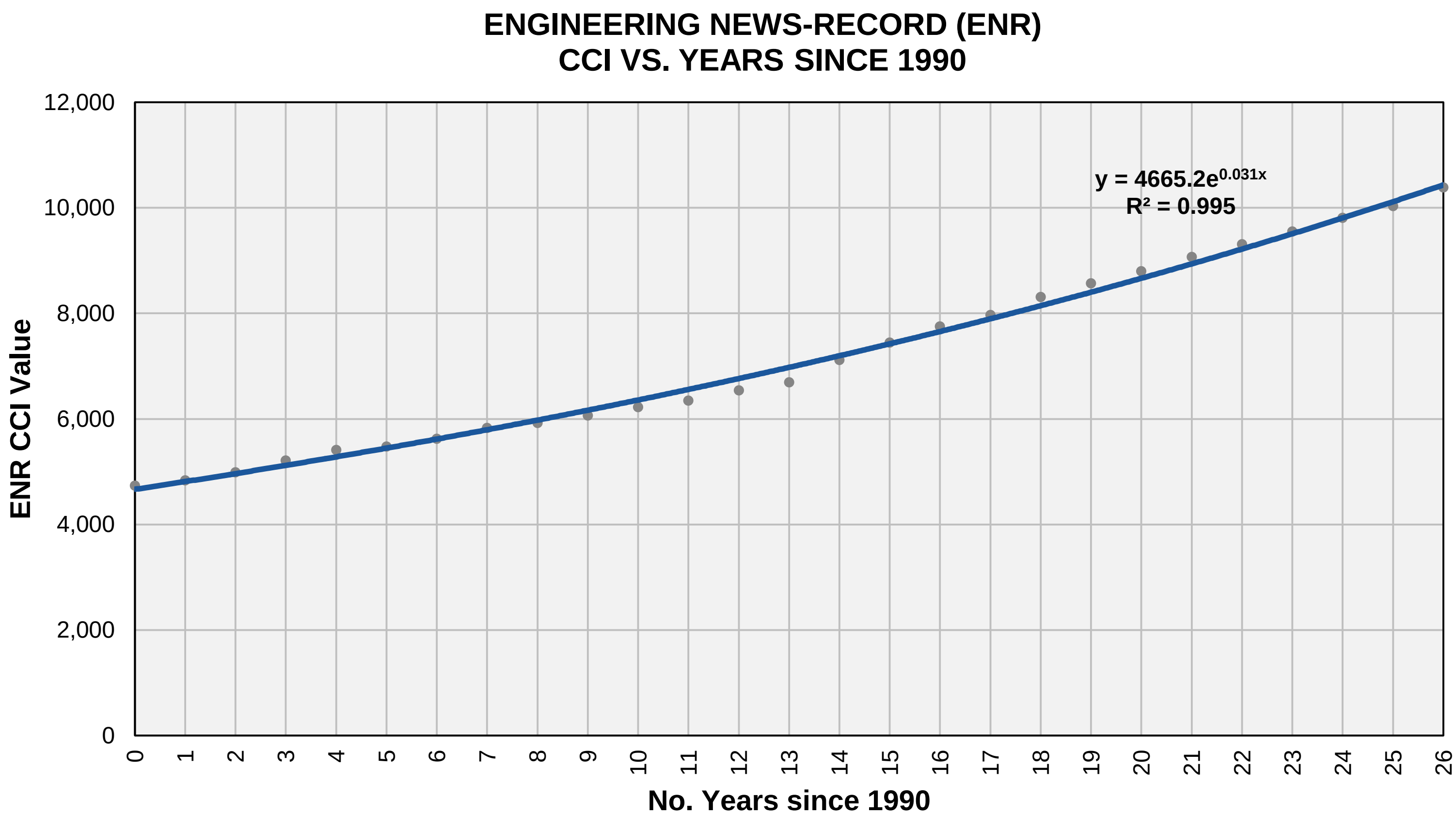
- Contract Packages
- Pipeline Lengths
- Pump Station Capacities

Time considerations – Cost Index

- ENR-CCI
  - August 2016 ENR Value:
    10,385
- Projection of Costs to Mid-Point of Construction (Discrete Contract Packages)

Forecasting Future Costs

- Escalation Trend



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Class 5 Level Cost Opinion

High Level Program Cost Evaluation Table		
	Program Element	Cost ($M)
1	Water Connection at Oak Creek	$0.0
2	Water Booster Pumping Station	$0.0
3	Water Reservoir	$0.0
4	Water Pipeline and Vaults	$0.0
5	Chemical Feed Facilities	$0.0
6	Water Connections at Waukesha	$0.0
7	Waukesha Water Distribution System Improvements	$0.0
8	Return Flow Pump Station	$0.0
9	Return Flow Pipeline and Vaults	$0.0
10	Outlet and Facilities at Root River (Wetlands / Aeration/Thermal)	$0.0
11	Necessary WWTP Improvements (Exclusive of Pump Station)	$0.0
12	Other Elements	$0.0
	Subtotal	**$0.0**
	Bonds and Insurance (at 3%)	$0.0
	Mobilization / Demobilization (at 5%)	$0.0
	Subtotal	**$0.0**
	Contingency (at 30%)	$0.0
	Subtotal	**$0.0**
	Contractor Overhead and Profit (at 15%)	$0.0
	Subtotal	**$0.0**
	Engineering (at 8%)	$0.0
	Permitting, Legal, and Administration (at 12%)	$0.0
	Engineering Services During Construction (at 8%)	$0.0
	Total	**$0.0**

Alternative Funding Evaluation Discussion

- WWU Current Funding Sources
- Expectations of Funding Agencies and Implications
- Strategic Targeting and Positioning for Other Funding Sources
  - TNC
- Plan Moving Forward

Summary Wrap-up

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Summary Wrap-Up

- Purpose of High-Level Cost Opinion Established?
- Audience to which the Cost Opinion will be Communicated Understood?
- Great Lakes Diversion Application Background Understood including Program Costs?
- Process for Updating Cost Opinion Established?
- Conceptual Planning for Alternative Funding Understood?

Next Meeting

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THANK YOU

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WAUKESHA WATER UTILITY
Great Lakes Water Supply Program
High Level Program Cost Evaluation Memorandum

High Level Program Cost Evaluation Table		
	Program Element	**Cost ($M)**
1	Water Connection at Oak Creek	$0.0
2	Water Booster Pumping Station	$0.0
3	Water Reservoir	$0.0
4	Water Pipeline and Vaults	$0.0
5	Chemical Feed Facilities	$0.0
6	Water Connections at Waukesha	$0.0
7	Waukesha Water Distribution System Improvements	$0.0
8	Return Flow Pump Station	$0.0
9	Return Flow Pipeline and Vaults	$0.0
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12	Other Elements	$0.0
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	Subtotal	**$0.0**
	Engineering (at 8%)	$0.0
	Permitting, Legal, and Administration (at 12%)	$0.0
	Engineering Services During Construction (at 8%)	$0.0
	Total	**$0.0**

Alternative 2 - Lake Michigan Supply

From Oak Creek. Return to Root River.

Captial Cost

	Quantity	Unit Cost	Total
Lake Michigan Supply Pump Station			
one PS @ 16.7 mgd and 210 psi	1	$ 8,830,125	$ 8,831,000
Lake Michigan Supply Pipeline			
20 miles of 30"	105,600	$ 408.00	$ 43,085,000
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AACE International Recommended Practice No. 18R-97

COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

Rev. March 1, 2016

Note: As AACE International Recommended Practices evolve over time, please refer to www.aacei.org for the latest revisions.

Contributors:

Disclaimer: The opinions expressed by the authors and contributors to this recommended practice are their own and do not necessarily reflect those of their employers, unless otherwise stated.

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COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES

TCM Framework: 7.3 – Cost Estimating and Budgeting

March 1, 2016

PURPOSE

As a recommended practice of AACE International, the *Cost Estimate Classification System* provides guidelines for applying the general principles of estimate classification to project cost estimates (i.e., cost estimates that are used to evaluate, approve, and/or fund projects). The *Cost Estimate Classification System* maps the phases and stages of project cost estimating together with a generic project scope definition maturity and quality matrix, which can be applied across a wide variety of process industries.

This addendum to the generic recommended practice (17R-97) provides guidelines for applying the principles of estimate classification specifically to project estimates for engineering, procurement, and construction (EPC) work for the process industries. This addendum supplements the generic recommended practice by providing:

- A section that further defines classification concepts as they apply to the process industries.
- A chart that maps the extent and maturity of estimate input information (project definition deliverables) against the class of estimate.

As with the generic recommended practice, the intent of this addendum is to improve communications among all of the stakeholders involved with preparing, evaluating, and using project cost estimates specifically for the process industries.

The overall purpose of this recommended practice is to provide the process industry with a project definition deliverable maturity matrix that is not provided in 17R-97. It also provides an approximate representation of the relationship of specific design input data and design deliverable maturity to the estimate accuracy and methodology used to produce the cost estimate. The estimate accuracy range is driven by many other variables and risks, so the maturity and quality of the scope definition available at the time of the estimate is not the sole determinate of accuracy; risk analysis is required for that purpose.

This document is intended to provide a guideline, not a standard. It is understood that each enterprise may have its own project and estimating processes and terminology, and may classify estimates in particular ways. This guideline provides a generic and generally acceptable classification system for process industries that can be used as a basis to compare against. This addendum should allow each user to better assess, define, and communicate their own processes and standards in the light of generally-accepted cost engineering practice.

INTRODUCTION

For the purposes of this addendum, the term “process industries” is assumed to include firms involved with the manufacturing and production of chemicals, petrochemicals, and hydrocarbon processing. The common thread among these industries (for the purpose of estimate classification) is their reliance on process flow diagrams (PFDs) and piping and instrument diagrams (P&IDs) as primary scope defining documents. These documents are key deliverables in determining the degree of project definition, and thus the extent and maturity of estimate input information.

Estimates for process facilities center on mechanical and chemical process equipment, and they have significant amounts of piping, instrumentation, and process controls involved. As such, this addendum may apply to portions of other industries, such as pharmaceutical, utility, water treatment, metallurgical, converting, and similar industries.

This addendum specifically does not address cost estimate classification in non-process industries such as commercial building construction, environmental remediation, transportation infrastructure, hydropower, "dry" processes such as assembly and manufacturing, "soft asset" production such as software development, and similar industries. It also does not specifically address estimates for the exploration, production, or transportation of mining or hydrocarbon materials, although it may apply to some of the intermediate processing steps in these systems.

The cost estimates covered by this addendum are for engineering, procurement, and construction (EPC) work only. It does not cover estimates for the products manufactured by the process facilities, or for research and development work in support of the process industries. This guideline does not cover the significant building construction that may be a part of process plants.

This guideline reflects generally-accepted cost engineering practices. This RP was based upon the practices of a wide range of companies in the process industries from around the world, as well as published references and standards. Company and public standards were solicited and reviewed, and the practices were found to have significant commonalities. These classifications are also supported by empirical process industry research of systemic risks and their correlation with cost growth and schedule slip[8].

COST ESTIMATE CLASSIFICATION MATRIX FOR THE PROCESS INDUSTRIES

A purpose of cost estimate classification is to align the estimating process with project stage-gate scope development and decision making processes.

Table 1 provides a summary of the characteristics of the five estimate classes. The maturity level of project definition is the sole determining (i.e., primary) characteristic of class. In Table 1, the maturity is roughly indicated by a percentage of complete definition; however, it is the maturity of the defining deliverables that is the determinant, not the percent. The specific deliverables, and their maturity or status are provided in Table 3. The other characteristics are secondary and are generally correlated with the maturity level of project definition deliverables, as discussed in the generic RP [2]. The post sanction classes (Class 1 and 2) are only indirectly covered where new funding is indicated. Again, the characteristics are typical and may vary depending on the circumstances.

March 1, 2016

	Primary Characteristic	***Secondary Characteristic***		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Table 1 – Cost Estimate Classification Matrix for Process Industries

This matrix and guideline outline an estimate classification system that is specific to the process industries. Refer to the generic estimate classification RP[1] for a general matrix that is non-industry specific, or to other addendums for guidelines that will provide more detailed information for application in other specific industries. These will provide additional information, particularly the project definition deliverable maturity matrix which determines the class in those particular industries.

Table 1 illustrates typical ranges of accuracy ranges that are associated with the process industries. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically to achieve a 50% probability of project overrun versus underrun) for given scope. Depending on the technical and project deliverables (and other variables) and risks associated with each estimate, the accuracy range for any particular estimate is expected to fall into the ranges identified (although extreme risks can lead to wider ranges).

In addition to the degree of project definition, estimate accuracy is also driven by other systemic risks such as:

- Level of non-familiar technology in the project.
- Complexity of the project.
- Quality of reference cost estimating data.
- Quality of assumptions used in preparing the estimate.
- Experience and skill level of the estimator.
- Estimating techniques employed.
- Time and level of effort budgeted to prepare the estimate.
- Unique/remote nature of project locations and the lack of reference data for these locations.
- The accuracy of the composition of the input and output process streams.

Systemic risks such as these are often the primary driver of accuracy, especially during the early stages of project definition. As project definition progresses, project-specific risks (e.g. risk events) become more prevalent and also drive the accuracy range[3]. Another concern in estimates is potential pressure for a predetermined value that may result in a biased estimate. The goal should be to always have an unbiased and objective estimate. The stated estimate ranges are dependent on this premise and a realistic view of the project.

Failure to appropriately address systemic risks (e.g. technical complexity) during risk analysis impacts the resulting probability distribution of the estimate costs, and therefore the interpretation of estimate accuracy.

Another way to look at the variability associated with estimate accuracy ranges is shown in Figure 1. Depending upon the technical complexity of the project, the availability of appropriate cost reference information, the degree of project definition, and the inclusion of appropriate contingency determination, a typical Class 5 estimate for a process industry project may have an accuracy range as broad as -50% to +100%, or as narrow as -20% to +30%.

Figure 1 also illustrates that the estimating accuracy ranges overlap the estimate classes. There are cases where a Class 5 estimate for a particular project may be as accurate as a Class 3 estimate for a different project. For example, similar accuracy ranges may occur if the Class 5 estimate of one project that is based on a repeat project with good cost history and data and, whereas the Class 3 estimate for another is for a project involving new technology. It is for this reason that Table 1 provides ranges of accuracy range values. This allows application of the specific circumstances inherent in a project, and an industry sector, to provide realistic estimate class accuracy range percentages. While a target range may be expected of a particular estimate, the accuracy range is determined through risk analysis of the specific project and is never pre-determined. AACE has recommended practices that address contingency determination and risk analysis methods.

If contingency has been addressed appropriately, approximately 80% of projects should fall within the ranges shown in Figure 1. However, this does not preclude a specific actual project result from falling inside or outside of the bands shown in Figure 1 indicating the expected accuracy ranges.

March 1, 2016

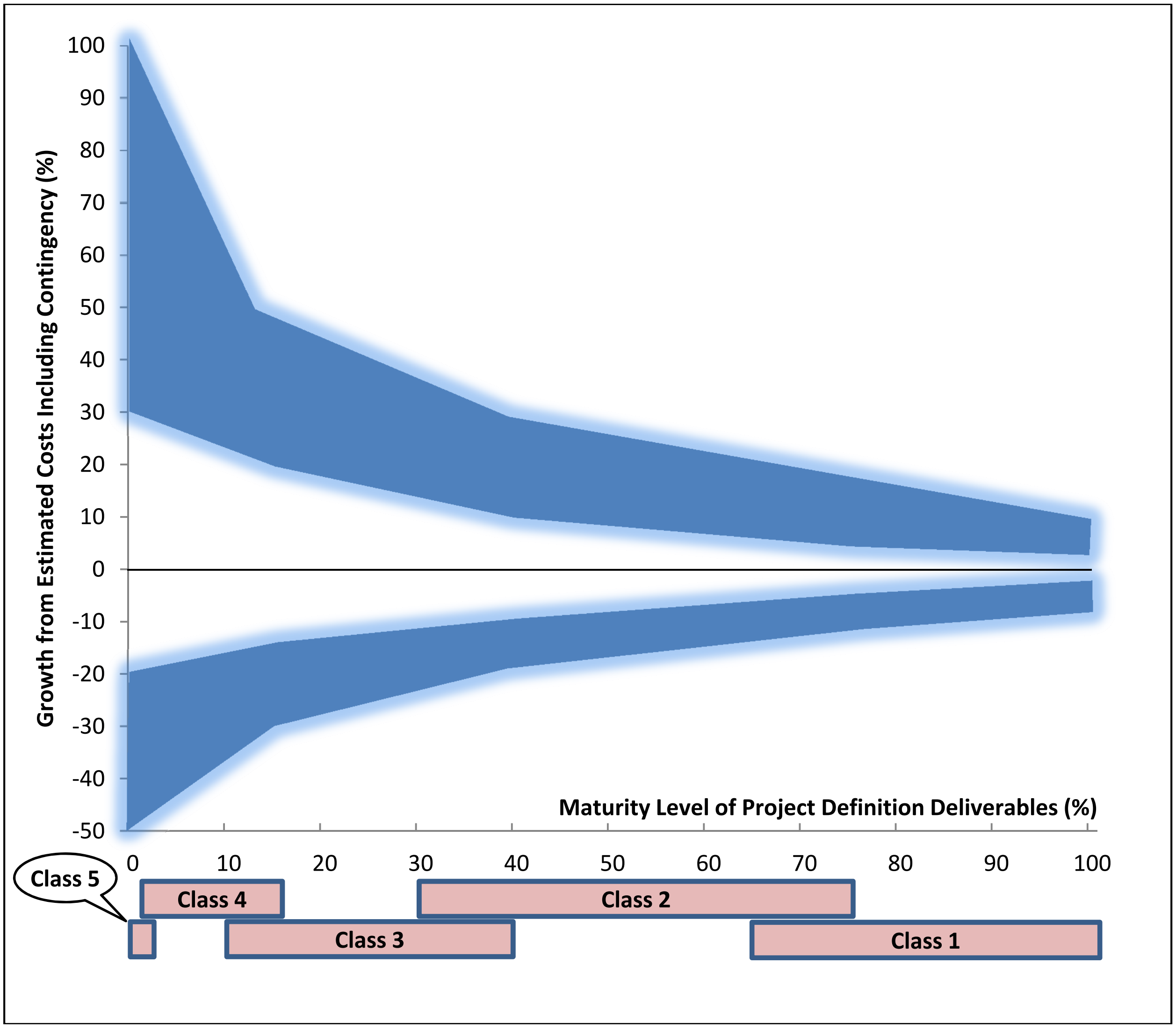

Figure 1 – Example of the Variability in Accuracy Ranges for a Process Industry Estimate

DETERMINATION OF THE COST ESTIMATE CLASS

The cost estimator makes the determination of the estimate class based upon the maturity level of project definition based on the status of specific key planning and design deliverables. The percent design completion may be correlated with the status, but the percentage should not be used as the estimate class determinant. While the determination of the status (and hence the estimate class) is somewhat subjective, having standards for the design input data, completeness and quality of the design deliverables will serve to make the determination more objective.

The Great Lakes Water Supply Program (Program) Phase 2 Preliminary Route Alternatives Report Workshop (4-100 W-01) was held at the Waukesha Water Utility, 115 Delafield St., Waukesha, WI 53187 at 9:00 a.m. on February 2, 2017. The purpose of the meeting was to recap the services performed in Phase 1 and agree on three route alternatives and Route Study process moving forward.

The attendees are listed on the attached sign-in sheet and the agenda is also attached. The below table summarizes action items from the workshop.

	Action Item	Action By	Due Date
1.	Provide information on improvements planned for Ryan Road	WWU	Complete
2.	Share decision making tool for criteria weighting with WWU	L. Melcher	Complete
3.	Develop schedule depicting interdependency between water and wastewater projects	C. Richardson	Complete
4.	Assign weights to Route Study evaluation criteria	WWU	Complete
5.	Determine planning period for Route Study life-cycle cost evaluation.	T. Wilson	Complete
6.	Identify preliminary average depth of cover for segments of each route	T. Wilson	Complete
7.	Prepare exhibit showing sub-alternates identified in the workshop and schedule meeting to review three alternates to evaluate for the Route Study.	T. Wilson	2/17/2017
8.	Provide date by which water supply agreement must be in place in order to maintain program schedule.	C. Richardson	2/17/2017
9.	Prepare diagram identifying anticipated demand conditions for Waukesha and potential future customers along the anticipated route.	L. Melcher	2/17/2017
10.	Review Route Study document use and intentions and provide comment	WWU	2/17/2017
11.	Review Draft Route Study Report outline and provide comment	WWU	2/17/2017
12.	Prepare a Task Authorization to perform a preliminary evaluation of the alternate supply route	C. Richardson	2/17/2017
13.	Establish “Roadmap” for Route Study and identify milestones and meeting requirements	T. Wilson	2/24/2017
14.	Perform evaluation of alternate supply route with respect to hydraulics and hydraulic grade line	T. Bluver	2/24/2017
15.	Update Evaluation matrix to incorporate Envision	C. Richardson	3/16/2017

1) Welcome

a) The team introduced themselves.

b) The workshop objectives were presented.

2) **Previous Key Decisions Made Relative to the Route Alternatives**
   a) Clarification to the anticipated Oak Creek connection locations was provided. The locations are Ryan Rd and 22nd or Puetz Rd and 27th.
   b) There was general acceptance to use 1" = 4' for vertical scale on profile sheets of plan sets.
   c) Assumed datums are not to be utilized for this Program. North American Datum of 1927 (NAD27) and the National Geodetic Vertical Datum of 1929 (NGVD29) will be utilized for this Program. Existing control diagrams used by the Southeast Wisconsin Regional Planning Commission (SEWRPC) will be the basis of control for this Program (reference 4-210-D1).

3) **Review of Evaluation Process to Reduce the Six Route Alternatives to Three Route Alternatives**
   a) The route evaluation process was reviewed.
   b) The services performed in Phase 1 were presented.

4) **Agreement on the Key Elements and Facilities associated with Each Route, Agreement on the Key Assumptions and Variables associated with Each Route**
   a) The key elements and facilities were reviewed.
   b) The key variables and assumptions were presented.
   c) Discussion was held regarding sizing of the corridor, planning segments of the route, and utilizing multiple supply pipes.
   d) Flushing devices shall be suitable for conveying intended flows. Hydrants shall not be utilized as flushing devices.
   e) Access to remote sites shall be provided with paved drives to the extent possible. Where paved access drives are not practical, a stabilized drive or other means of ingress/egress shall be provided to maintain the system.
   f) The PM/CM team will identify average depth of cover for segments of each route. The bury depth will be considered when generating costs for evaluation.
   g) Discussion was held regarding the minimum operating pressure in the water supply pipe. It was noted that 35 psi is what Wisconsin Code NR 811 requires for a distribution systems minimum operating pressure. Operating pressures will be discussed in a future meeting once the hydraulics are further refined.
   h) Life-cycle costs for each alternative will include additional equipment and staff required to maintain the new supply and return lines. It was noted that some work items related to maintenance or repair of the pipes and appurtenances may be sourced to private entities or contractors.

5) **Review of Each of the Six Route Alternatives**
   a) The development of the route alternatives was presented including the evaluation limits and areas to avoid.
   b) Each of the initial six route alternatives were presented.
   c) It was noted that there are two large gas transmission mains in the region. The gas transmission line east of Waukesha was located.

d) Discussion was held regarding improvements along Ryan Road. It was stated that the improvements are already in the 60% design stage and construction is planned for 2017. The PM/CM team will confirm the schedule with Milwaukee County. It may be necessary to request that the full reconstruction be delayed.
e) WWU requested that the Booster Pumping Station be located as close to Waukesha as possible for ease of maintenance access without negatively impacting design or operations. In addition, it was requested that the system be designed to be as "maintenance free" as possible due to staffing considerations.

6) Other Route Alternatives for Consideration

a) Other potential routes were discussed.
b) Any evaluation of an alternate supply route will be added to the Route Study Report as an Appendix.
c) Other sub-alternate routes to the existing routes were identified, documented and discussed. The sub-alternates include the I-43 right-of-way and cross country corridors. These sub-alternates will be quickly evaluated and reviewed with WWU to determine the three alternates to begin evaluating for the Route Study.
d) Discussion was held regarding the Route 164 corridor. It was discussed that at least one route should include the segment of Route 164 north of I-43 to Waukesha.

7) Review Evaluation Process Results, Recommended Three Alternative Routes for Further Evaluation

a) The evaluation process and results of the Preliminary Route Alternatives were presented.
b) It was identified that the non-economic weighting and scoring along with economic comparative costs resulted in preferred alternatives 2, 3, and 4.
c) It was noted that based on feedback from WWU, Alternative 4 would utilize a combination of routes 4 and 5 to take advantage of the "Bike Path"/ WE Energies corridor and Racine Avenue.
d) The "weak links" of the six preliminary routes are on the east-west roadways between Racine Avenue and Moorland Road.

8) Review and Agreement on Evaluation Process to Reduce the Three Remaining Route Alternatives to One

a) The Route Study will utilize the same process used to evaluate the preliminary route alternatives.
b) The Route Study criteria were presented and discussed.
c) Discussion was held regarding Triple Bottom Line and Envision evaluations. It was noted that Envision is a tool developed to provide a sustainability rating system for infrastructure. It was noted that it also may serve as a source of justification for debt free funding in the form of grants provided by interested private parties. One example presented was that gifts had been provided to others by Johnson Wax in the past. It was further noted that any support from strong private entities in strategic locations would only serve to benefit the program.
d) Gained consensus to incorporate the Envision process in all Program tasks.
e) The Route Study Report will be developed as a multi-use tool similar to the Design Reports. A handout was provided identifying the intended uses of the report.

9) Summary Wrap-up and Action Items

a) Gained consensus on the evaluation process results for evaluating six routes and narrowing to three route alternatives.
b) Agreed on the key elements and facilities associated with each route and the key assumptions and variables associated with each route.
c) Agreement was reached regarding the three preferred alternatives presented in the Preliminary Route Alternatives Evaluation. The three preferred routes are 2, 3 and a combination of routes 4 and 5. It is noted that the sub-alternates identified in the workshop will be quickly evaluated and vetted with WWU to determine any modifications to the aforementioned preferred routes prior to proceeding with the Route Study.
d) Gained consensus on the evaluation process to reduce from three routes to a final preferred route selection.
e) Action items were discussed and summarized in the table on page1.

This meeting summary reflects the discussions and decisions reached at the workshop. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the workshop.

Waukesha Water Utility

Great Lakes Water Supply Program

Preliminary Route Alternatives Report Workshop (4-100 W-01)
Sign-in Sheet
February 2, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	
3	Jeff Detro	Waukesha Water Utility	
4	Paul Vogel	Greeley and Hansen	
5	Nicole Spieles	Greeley and Hansen	
6	Katie Richardson	Greeley and Hansen	
7	Thomas Wilson	Greeley and Hansen	
8	Lee Melcher	Greeley and Hansen	
9	Kevin Richardson	Kevin Richardson Consulting	
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Preliminary Route Alternatives Report Workshop (4-100 W-01) Agenda
February 2, 2017

Location: WWU Large Conference Room

Time: 9 a.m. – 1:30 p.m.

Time	Topic	Presenter(s)
9:00 a.m.	Welcome Introductions Agenda Overview (Handout) Workshop Objectives	Nicole Spieles
9:10 a.m.	Previous Key Decisions Made Relative to the Route Alternatives	Tom Wilson
9:40 a.m.	Review of Evaluation Process to Reduce the 6 Route Alternatives to 3 Route Alternatives	Paul Vogel
10:20 a.m.	Agreement on the Key Elements and Facilities associated with Each Route Agreement on the Key Assumptions and Variables associated with Each Route	Tom Wilson
11:00 a.m.	Review of Each of the 6 Route Alternatives	Lee Melcher
11:30 a.m.	Other Route Alternatives for Consideration	Tom Wilson
12:00 p.m.	Lunch	
12:30 p.m.	Review Evaluation Process Results Recommended 3 Alternative Routes for Further Evaluation	Tom Wilson
12:50 p.m.	Review and Agreement of Evaluation Process to Reduce the 3 Remaining Route Alternatives to 1	Paul Vogel
1:20 p.m.	Summary Wrap-up and Action Items	Nicole Spieles/Katie Richardson
1:30 p.m.	Adjourn	

Scheduled Attendees:

Dan Duchniak
Kelly Zylstra
Jeff Detro
Nicole Spieles
Katie Richardson
Tom Wilson
Lee Melcher
Paul Vogel
Kevin Richardson

The Great Water Alliance (Program) Route Study – Alternative Routes Review Meeting (4-100 M-01) was held at the Waukesha Water Utility, 115 Delafield St., Waukesha, WI 53187 at 9:30 a.m. on March 2, 2017. The purpose of the meeting was to review route evaluation criteria weightings by WWU and agree on three route alternatives for the Route Study.

The attendees are listed on the attached sign-in sheet and the agenda is also attached. The below table summarizes action items from the meeting.

Action Item		Action By	Due Date
1.	Confirm WDNR disinfectant injection, pumping, and dosage requirements	L. Melcher	3/8/2017
2.	Update figure to reflect three Routes that were agreed to move forward for further evaluation in the Route Study and shared with Kelly and Dan	T. Bluver	3//10/2017
3.	Split flexibility into two criteria	T. Wilson	4/6/2017
4.	Confirm chemical addition requirements needed if using an alternate supplier	C. Richardson	5/1/2017

1) **Welcome**
   a) The agenda and meeting objectives were presented.
   b) The key work recently performed was discussed.

2) **Route Evaluation Criteria Weightings**
   a) Criteria weightings provided by Dan, Kelly and Jeff at WWU were reviewed and discussed.
   b) WWU's interpretation of the Feasibility criterion was discussed. It was agreed that the Route Study will include only feasible routes.
   c) K. Zylstra shared her interpretation of the Flexibility criterion, after discussion with the team it was decided that the Flexibility criterion would be split into two areas of evaluation.
   d) Criteria definitions will not be provided alongside criteria when weighting to foster open discussion.

3) **Moorland Road to Racine Avenue**
   a) Feasible route sub-alternatives were identified and key aspects of each route were discussed.
   b) Key notes regarding the discussion were as follows.
      i) Potential to mill Ryan Road in interim prior to constructing pipelines; Ryan Road could be fully reconstructed as pipelines are constructed.
   c) Route sub-alternatives were compared.
   d) Preferred route sub-alternatives to Routes 2 and 3 were selected for further evaluation in Phase 2:
      i) Route Sub-Alternative 2.7, utilizing Calhoun Road, cross country easements, National Avenue, and Lawnsdale Road, was selected as the preferred sub-alternative for Route 2.
      ii) Utilizing a potential easement or easements adjacent to I-43 was selected as the preferred sub-alternative for Route 3.

iii) WWU concurred that the Phase 2 Route Study can proceed for Routes 2 and 3 with the configurations noted in 3.d.i and 3.d.ii.

4) Racine Avenue to Route 164

a) Feasible route sub-alternatives were identified and key aspects of each route were discussed.
b) Route sub-alternatives were compared.
c) Preferred route sub-alternatives for Route 4 were selected for further evaluation in Phase 2:
   i) Route Sub-Alternative 4.1, utilizing Tans Drive, Crowbar Drive, cross country easements, and Town Line Road, was selected as the preferred sub-alternative for Route 4.
   ii) Challenging portions of Tans Drive and the We Energies Power Corridor were noted.
   iii) WWU concurred that the Phase 2 Route Study can proceed for Route 4 with the configuration noted in 4.c.i.

5) Alternate Supply Route

a) The Alternate Supply Route and Alternate Supply Route Sub-Alternative were discussed.
b) Preliminary hydraulic grade lines (HGLs) for the Alternate Supply Route and Alternate Supply Route Sub-Alternative were presented. Potential to utilize storage near Minooka Park in lieu of a second pumping facility was discussed. The PM/CM team will confirm chemical addition requirements needed if using an alternate supplier.

6) Draft Route Study Report Outline Review

a) The Draft Route Study Report Outline was updated per WWU comments.
b) WWU was provided with a response identifying how WWU comments were addressed regarding the Draft Route Study Report Outline.

7) Summary Wrap-up and Action Items

a) Reviewed recent work performed to recommend 3 route alternatives.
b) Reviewed route evaluation criteria weightings by WWU.
c) Gained consensus on the routes between Moorland Road and Racine Avenue.
d) Gained consensus on the route between Racine Avenue and Route 164.
e) Reviewed alternate supply route and alternative supply route sub-alternative.
f) Reviewed and gained consensus on the Draft Route Study Report Outline.
g) Action items were discussed and summarized in the table on page 1.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

Waukesha Water Utility

Great Lakes Water Supply Program

Route Study (4-100 M-01) - Alternative Routes Review Meeting Sign-in Sheet March 2, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	
3	Nicole Spieles	Greeley and Hansen	
4	Katie Richardson	Greeley and Hansen	
5	Thomas Wilson	Greeley and Hansen	
6	Lee Melcher	Greeley and Hansen	
7	Ted Bluver	Greeley and Hansen	
8	Kevin Richardson	Kevin Richardson Consulting	
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Route Study – Alternative Routes Review Meeting (4-100 M-01) Agenda
March 2, 2017

Location: WWU Large Conference Room

Time: 9:30 a.m. – 12:00 p.m.

Attendees:

Dan Duchniak
Kelly Zylstra
Ted Bluver
Lee Melcher
Katie Richardson
Nicole Spieles
Tom Wilson
Kevin Richardson

Time	Topic	Presenter(s)
9:30 a.m.	Welcome • Agenda Overview (Handout) • Meeting Objectives • Key Work Recently Performed	Nicole Spieles
9:40 a.m.	Route Evaluation Criteria Weightings	Tom Wilson
10:00 a.m.	Moorland Road to Racine Avenue • Sub-Alternatives • Pros and Cons • Routes for Further Evaluation	Tom Wilson; Ted Bluver
10:30 a.m.	Racine Avenue to Route 164 • Sub-Alternatives • Pros and Cons • Routes for Further Evaluation	Tom Wilson; Ted Bluver
11:00 a.m.	Alternate Supply Route	Tom Wilson
11:30 a.m.	Draft Route Study Report Outline Review	Tom Wilson
11:50 p.m.	Summary Wrap-Up and Action Items	Ted Bluver, Katie Richardson
12:00 p.m.	Adjourn	

WORKSHOP SUMMARY

The Great Lakes Water Supply Program (Program) Alternate Supply Route Review Workshop was held in the WWU Large Conference Room at 1:00 p.m. on April 19, 2017 to review the Alternate Supply Route economic and non-economic evaluation. The evaluation results will be codified in the Alternate Supply Route Technical Memorandum (TM). The attendees are listed on the attached sign-in sheet. The agenda is attached.

Action Item		Action By	Due Date
1.	Add rate discussion to TM	T. Bluver	4/28/2017
2.	Add water quality discussion with Consumer Confidence Reports to TM	T. Wilson	4/28/2017
3.	Engage public relations programmatic support services team on messaging related to evaluation.Submit draft TM	N. Spieles	5/4/2017
4.	Proceed with incorporating an energy recovery evaluation into the facilities design reports	T. Bluver	8/1/2017

1) **Welcome**
   a) The agenda, workshop objectives, and key work recently performed were discussed.
   b) The Alternate Supply Route evaluation was performed in a similar manner as that which was completed for the six routes in in Phase 1.

2) **Alternate Supply Route Development**
   a) The Alternate Supply Route and Alternate Supply Route Sub-Alternative were presented and discussed.
   b) The return flow follows Route Alternative 2, of the original route alternatives, to the Root River.

3) **Preliminary Hydraulics**
   a) The water supply and return flow system hydraulics were discussed. Anticpated key ey infrastructure for each system were identified; power requirements and energy recovery opportunities were discussed.
   b) Assumptions were kept consistent with Phase 1 evaluation in performing hydraulic modeling.
   c) A brief overview of the topography at Minooka Park indicates that there are locations at the park that could support a ground storage reservoir that could be connected to the central zone and provide an HGL of 1,000.
   d) Maintaining a positive pressure in the return flow pipe allows for leak detection, conserves head loss, reduces hydraulic transients, and supports smooth pumping conditions.
   e) WWU indicated additional evaluation of energy recovery opportunities is warranted.

4) **Opinions of Probable Cost**
   a) The Application Cost, Comparative Program Cost, and Conceptual Opinion of Probable Construction Cost (for pipelines only) was presented.
   b) The Alternate Supply Route and Alternate Supply Route Sub-Alternative are economically comparable.
   c) The Alternate Supply Route and Alternate Supply Route Sub-Alternative differ from the Phase 1 route alternatives by an amount that lies within the accuracy and contingency for all alternatives evaluated.

d) Rate, risk, and water quality discussion supported with Consumer Confidence Reports are to be included in TM.

5) Desktop Review

a) The criteria and weighting for the Alternate Supply Route was kept consistent with those used in Phase 1.
b) Route scores were presented and the Alternate Supply Route Sub-Alternative was identified as more preferable than the Alternate Supply Route on a non-economic basis. Neither the Alternate Supply Route nor the Alternate Supply Route Sub-Alternative were scored significantly better than the original six route alternatives however the scores for the eight routes cannot be directly compared due to the fact that alternate supply routes did not exist when the original six routes were scored.

6) Summary Wrap-Up and Action Items

a) No further evaluation of the Alternate Supply Route is required at this time.
b) Action Items:
   i) Complete TM.
   ii) Proceed with Route Study for Route Alternatives 2, 3, and 4.
   iii) Engage programmatic support services team on messaging related to the Alternate Supply Route analysis.

This workshop summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the workshop.

GREAT WATER
ALLIANCE

ALTERNATE SUPPLY ROUTE REVIEW WORKSHOP
SIGN-IN SHEET

April 19, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	
3	Nicole Spieles	Greeley and Hansen	
4	Katie Richardson	Greeley and Hansen	
5	Thomas Wilson	Greeley and Hansen	
6	Lee Melcher	Greeley and Hansen	
7	Ted Bluver	Greeley and Hansen	
8	Kevin Richardson	Kevin Richardson Consulting	
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AGENDA

Date/Time: April 19, 2017, 1:00 p.m. – 3:00 p.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Lee Melcher, GH
Katie Richardson, GH
Nicole Spieles, GH
Tom Wilson, GH
Kevin Richardson

Time	Topic	Presenter(s)
1:00 p.m.	Welcome – Agenda Overview (Handout) – Workshop Objectives – Key Work Recently Performed	Nicole Spieles
1:10 p.m.	Alternate Supply Route Development	Tom Wilson
1:30 p.m.	Preliminary Hydraulics – Water Supply System – Return Flow System	Ted Bluver
2:00 p.m.	Opinions of Probable Cost – Initial Program Cost – Comparative Program Cost – Conceptual Opinion of Probable Cost	Ted Bluver; Tom Wilson
2:30 p.m.	Desktop Review – Criteria and Weighting – Route Scoring	Tom Wilson
2:50 p.m.	Summary Wrap-Up and Action Items	Ted Bluver, Katie Richardson
3:00 p.m.	Adjourn	

MEETING SUMMARY

The Great Lakes Water Supply Program (Program) Route Meeting on Ryan Road Sub-Alternatives and Criteria Weighting with Envision was held in the Waukesha Water Utility (WWU) Large Conference Room at 9:00 a.m. on May 18, 2017. The purpose of the meeting was to identify a preferred route along the Milwaukee County-owned portion of Ryan Road and discuss how Envision will be utilized as part of the Route Study evaluations for the Program. The attendees are listed on the attached sign-in sheet. The agenda and presentation materials are also attached.

	Action Item	Action By	Due Date
1.	Confirm depth and horizontal alignment of MMSD interceptor along Ryan Road.	T. Bluver	**5/26/17**

1) **Welcome**
   a) The agenda, meeting objectives, and key work recently performed were discussed including the development of Ryan Road Sub-Alternatives and using Envision criteria paired with non-economic criteria.
2) **Ryan Road**
   a) The Ryan Road route study area and the Ryan Road Route Sub-Alternatives were presented.
   b) The Ryan Road Route Sub-Alternative evaluation is applicable to either water supply under consideration for the Program; at least one pipeline will be aligned within the Milwaukee County-owned portion of Ryan Road.
   c) Proposed developments and opportunities in the City of Franklin were discussed. Route Sub-Alternative R-3 could supply water to a planned development south of Oakwood Road, but would require a water supply over a 24-hour period and would limit potential pumping strategies for the water supply system. Excavated materials from any Route Sub-Alternative R-1 through R-3 may be able to support raising Ryan Road, if construction timelines align.
   d) Ryan Road Sub-Alternatives were compared based on economic and non-economic criteria. It was determined additional cost for routes that differ from the Ryan Road corridor increase the length, cost, and schedule of the Program and are not preferred.
   e) The Route Study is to proceed with Ryan Road Sub-Alternative R-1 as the selected route along this potion of Ryan Road.

3) **Envision**
   a) An overview of Envision was presented.
   b) Benefits of Envision for the Program were presented.
   c) Envision aligns with the requirements of both the Program and the requirements of the Public Service Commission (PSC).
   d) The non-economic criteria were reviewed for the Route Study. Flexibility was split into two criteria – Future Connections and Operational Flexibility. The Feasibility criterion was removed. The non-economic criteria are in alignment with Envision criteria.

e) The application of Envision to the Program was discussed. Envision will be used to support planning and design level decisions for the Program, including but not limited to the Route Study.

4) Summary Wrap-Up and Action Items

a) Ryan Road Route Sub-Alternative R-1 was selected as the preferred route along the Milwaukee County-owned portion of Ryan Road. The Route Study is to proceed using Ryan Road Route Sub-Alternative R-1.
b) Envision will be utilized in assisting in the Program's decision making processes and alternatives analyses.
c) Note action items listed on page 1 of this summary.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER ALLIANCE

ROUTE MEETING: RYAN ROAD SUB-ALTERNATIVES AND CRITERIA WEIGHTING WITH ENVISION
SIGN-IN SHEET

May 18, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	[redacted]
3	Nicole Spieles	Greeley and Hansen	[redacted]
4	Katie Richardson	Greeley and Hansen	[redacted]
5	Thomas Wilson	Greeley and Hansen	[redacted]
6	Mike Pekkala	Greeley and Hansen	[redacted]
7	Ted Bluver	Greeley and Hansen	[redacted]
8	Kevin Richardson	Kevin Richardson Consulting	[redacted]
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AGENDA

Date/Time: May 18, 2017, 9:00 a.m. – 10:00 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Katie Richardson, GH
Nicole Spieles, GH
Tom Wilson, GH
Kevin Richardson, KRC

Time	Topic	Presenter(s)
9:00 a.m.	Welcome - Agenda Overview (Handout) - Workshop Objectives - Key Work Recently Performed	Nicole Spieles; Tom Wilson
9:05 a.m.	Ryan Road - Sub-Alternatives Developed - Sub-Alternative Comparison - Preferred Route	Ted Bluver; Tom Wilson
9:30 a.m.	Envision - Overview - Program Benefits - Application to Program	Nicole Spieles
9:55 a.m.	Summary Wrap-Up and Action Items	Ted Bluver; Katie Richardson
10:00 a.m.	Adjourn	

Great Lakes Water Supply Program

Great Water Alliance | Meeting No. 2

Route Meeting: Ryan Road Sub-Alternatives and Criteria Weighting with Envision

May 18, 2017

GREAT WATER ALLIANCE™

GREELEY AND HANSEN

Workshop Objectives

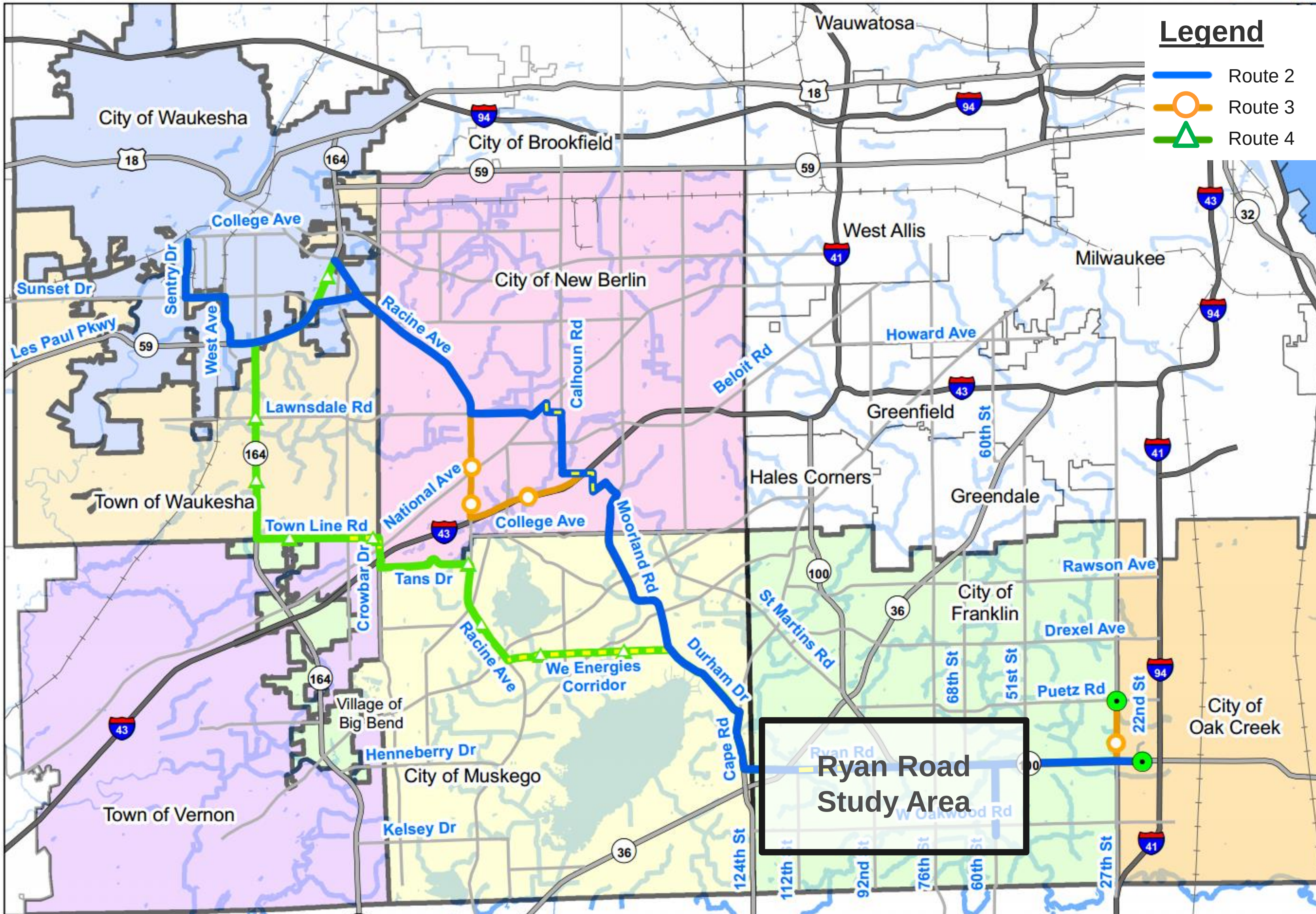
- Gain Consensus on the Route on Ryan Road between 60th Street and 112th Street, including the:
  - Sub-alternatives identified;
  - Sub-alternative comparison; and
  - Preferred route.
- Discuss Envision, including:
  - A general understanding of Envision,
  - A review of Envision benefits for WWU; and
  - How we apply Envision to the Route Study and the Great Water Alliance.

Key Work Recently Performed

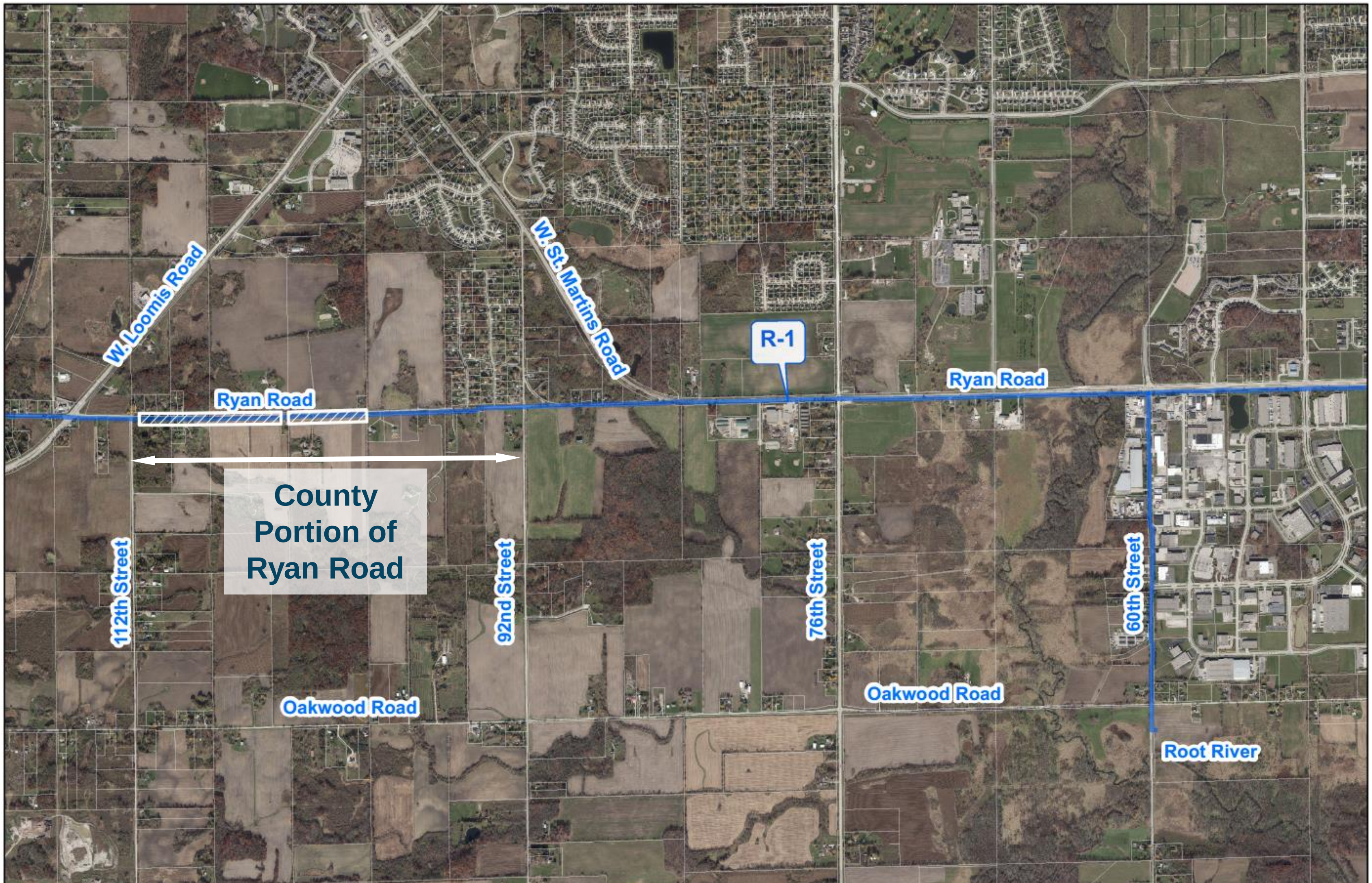
- Identified Ryan Road Sub-Alternatives between 60th Street and 112th Street
- Developed Comparative Costs for Ryan Road Sub-Alternatives
- Performed Desktop Review of Ryan Road Sub-Alternatives
- Identified Preferred Ryan Road Sub-Alternative
- Developed Envision Matrix and Paired Route Study Non-Economic Criteria to Envision

Ryan Road

Ryan Road: Sub-Alternatives Developed

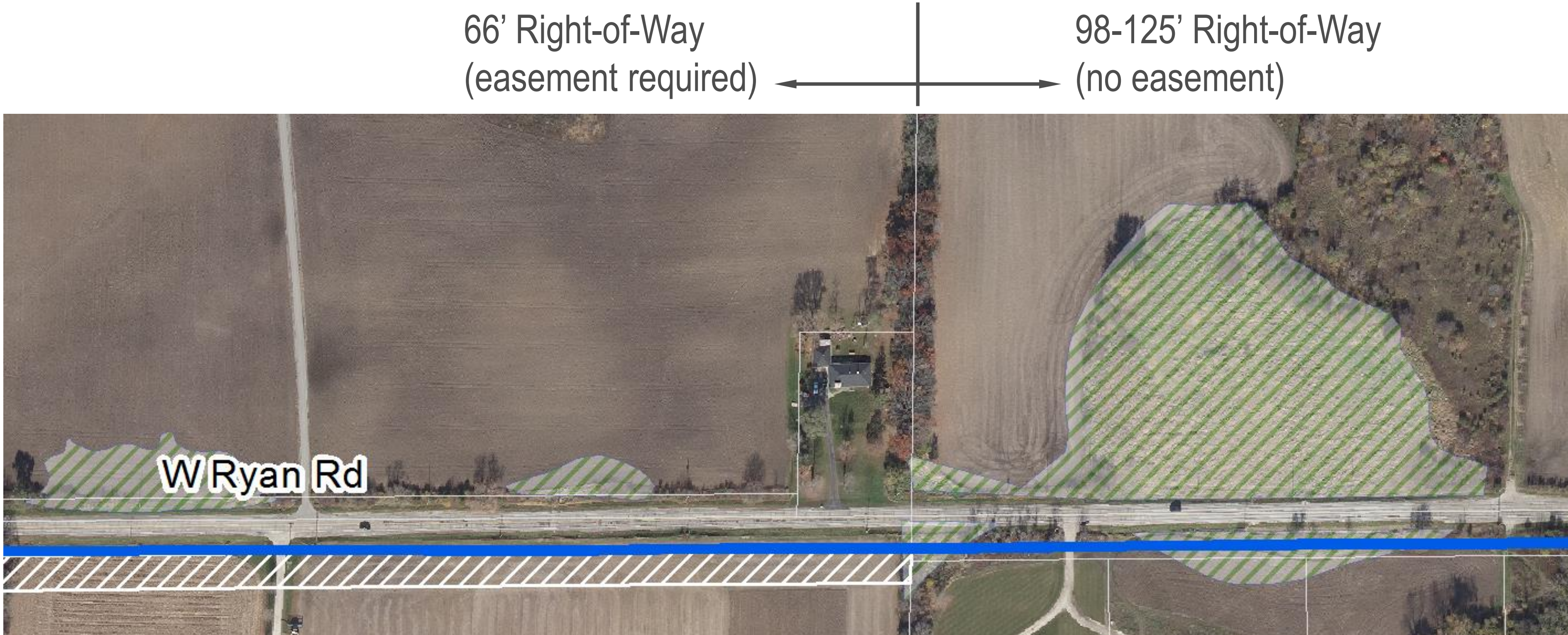


Ryan Road: Sub-Alternatives Developed

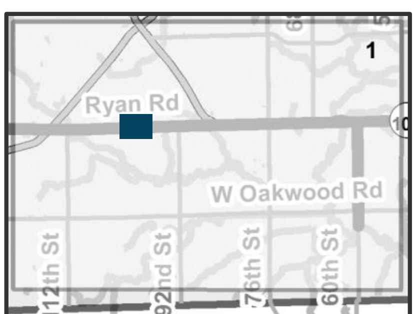


Sub-Alternative R-1 – Ryan Road Alignment

Ryan Road: Sub-Alternatives Developed

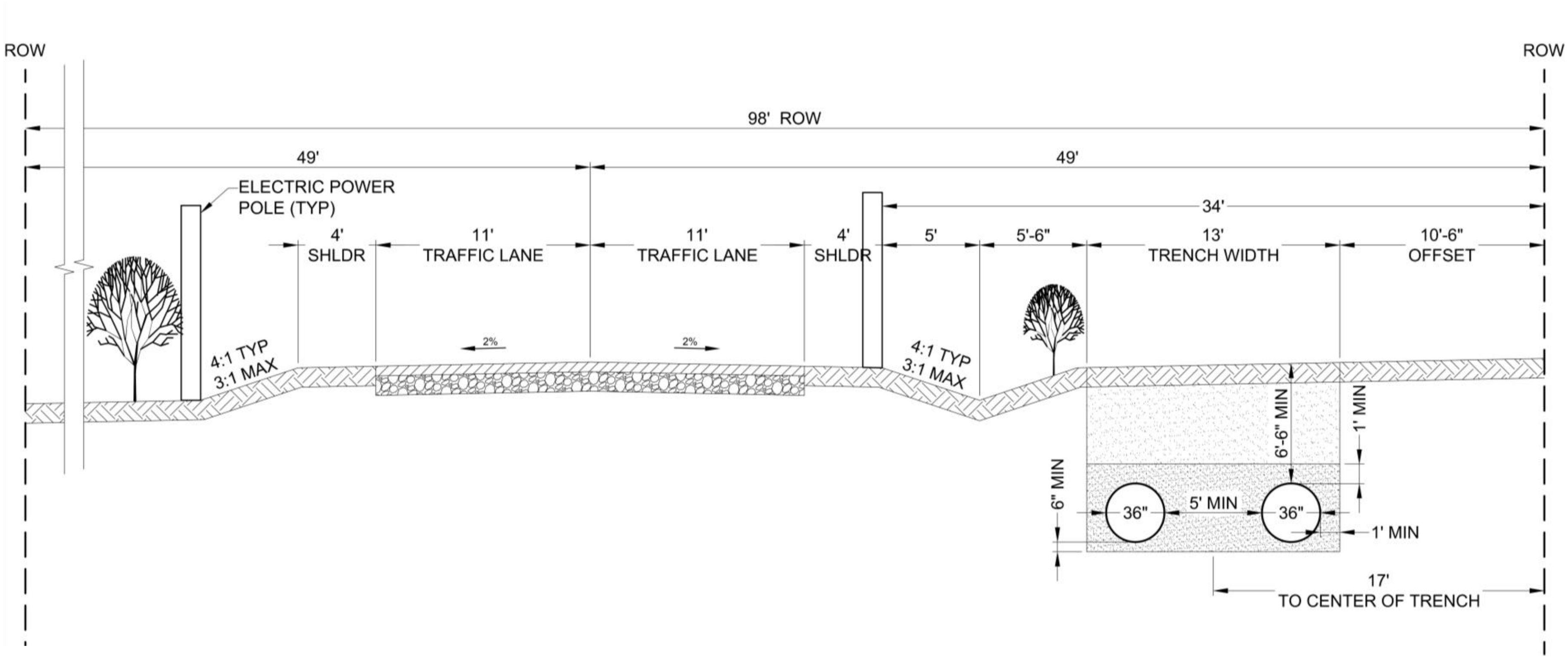


Key Map:

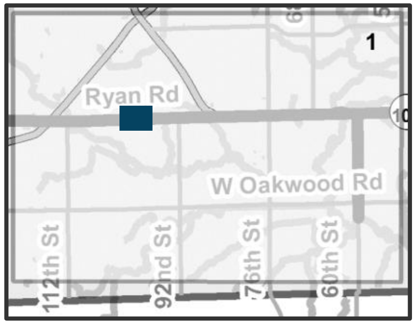


Sub-Alternative R-1 –
Right-of-Way / Easement Requirements

Ryan Road: Sub-Alternatives Developed

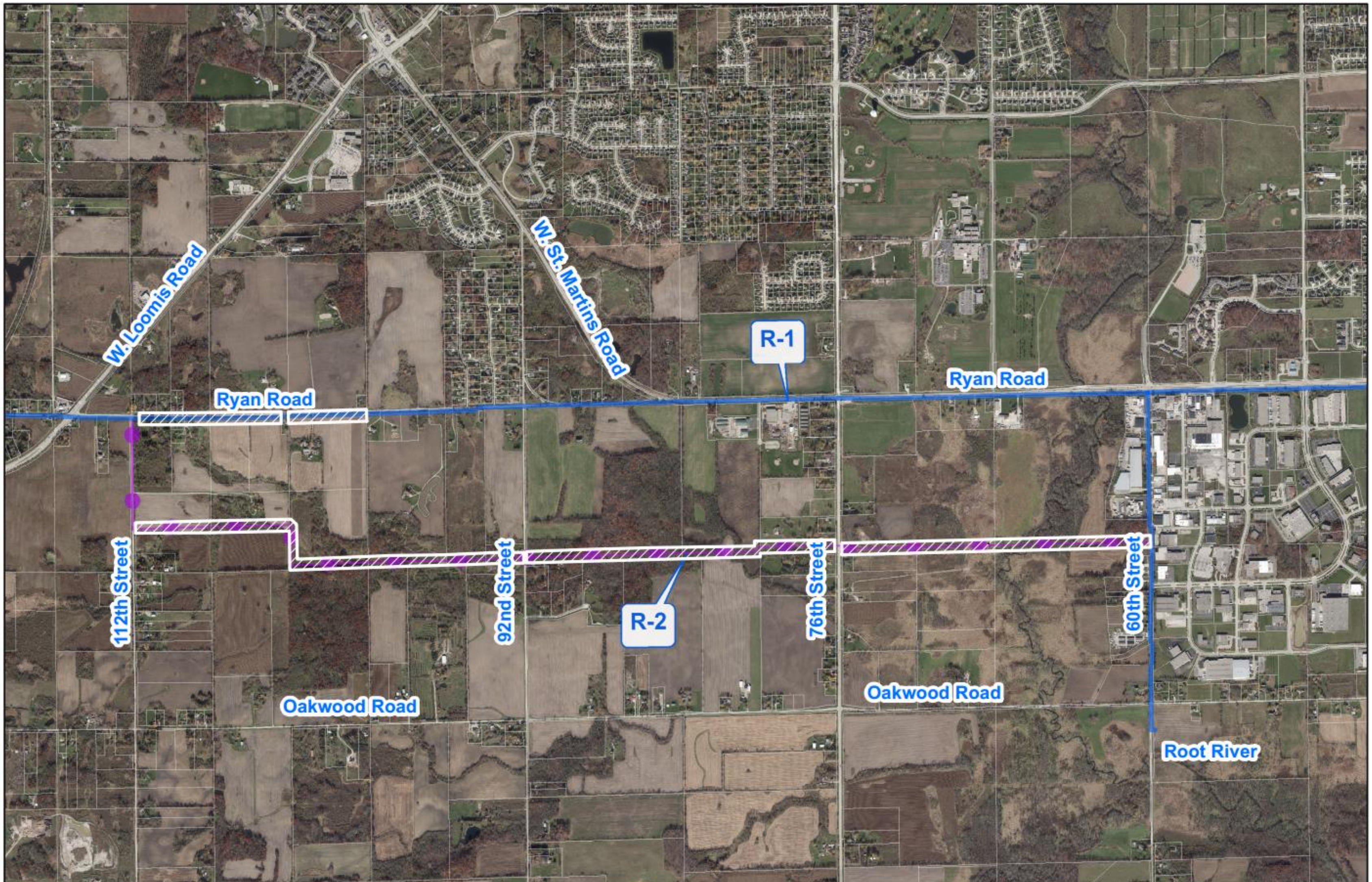


Key Map:



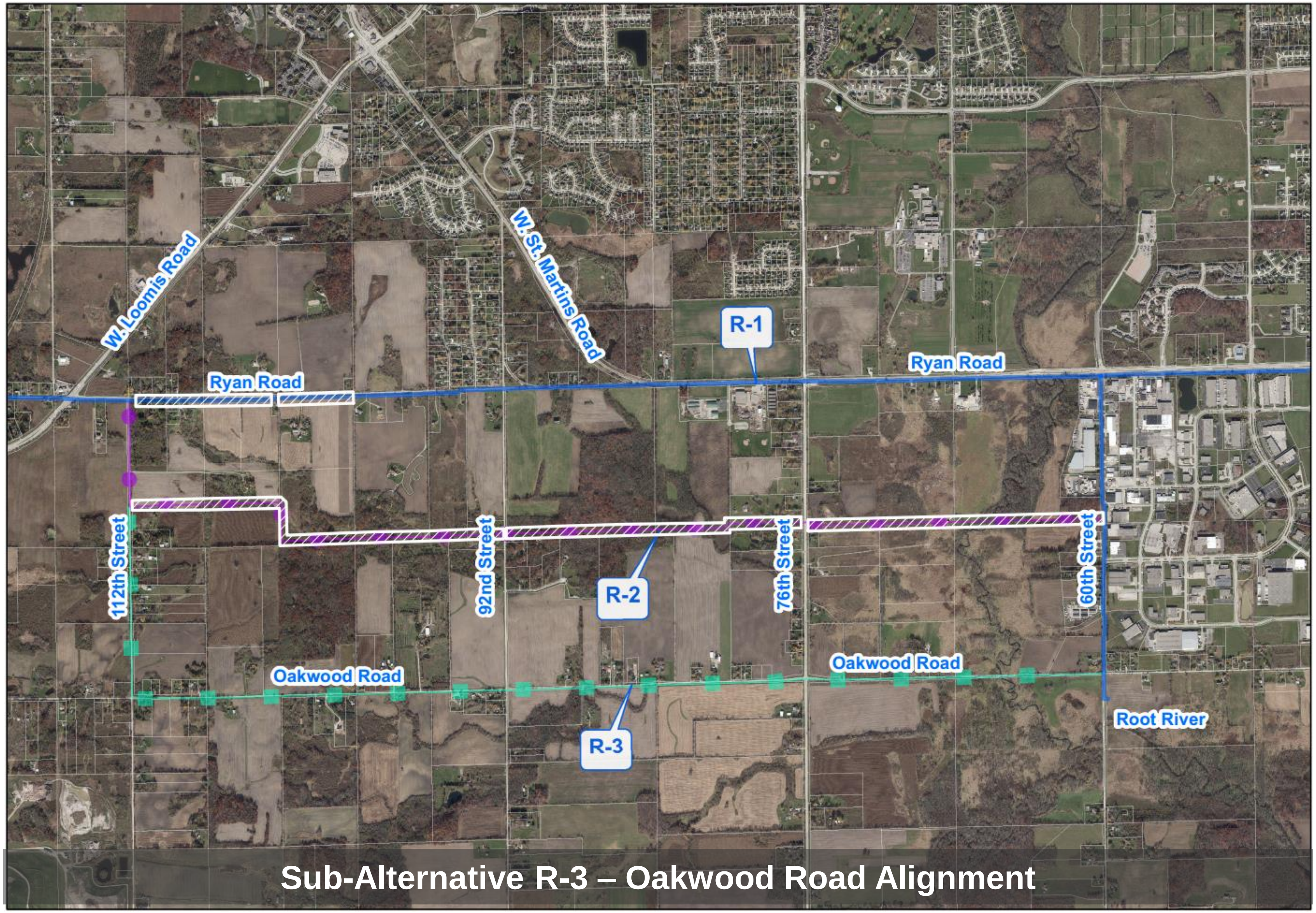
Sub-Alternative R-1 –
Typical Trench Section for 98' Right-of-Way Facing East

Ryan Road: Sub-Alternatives Developed



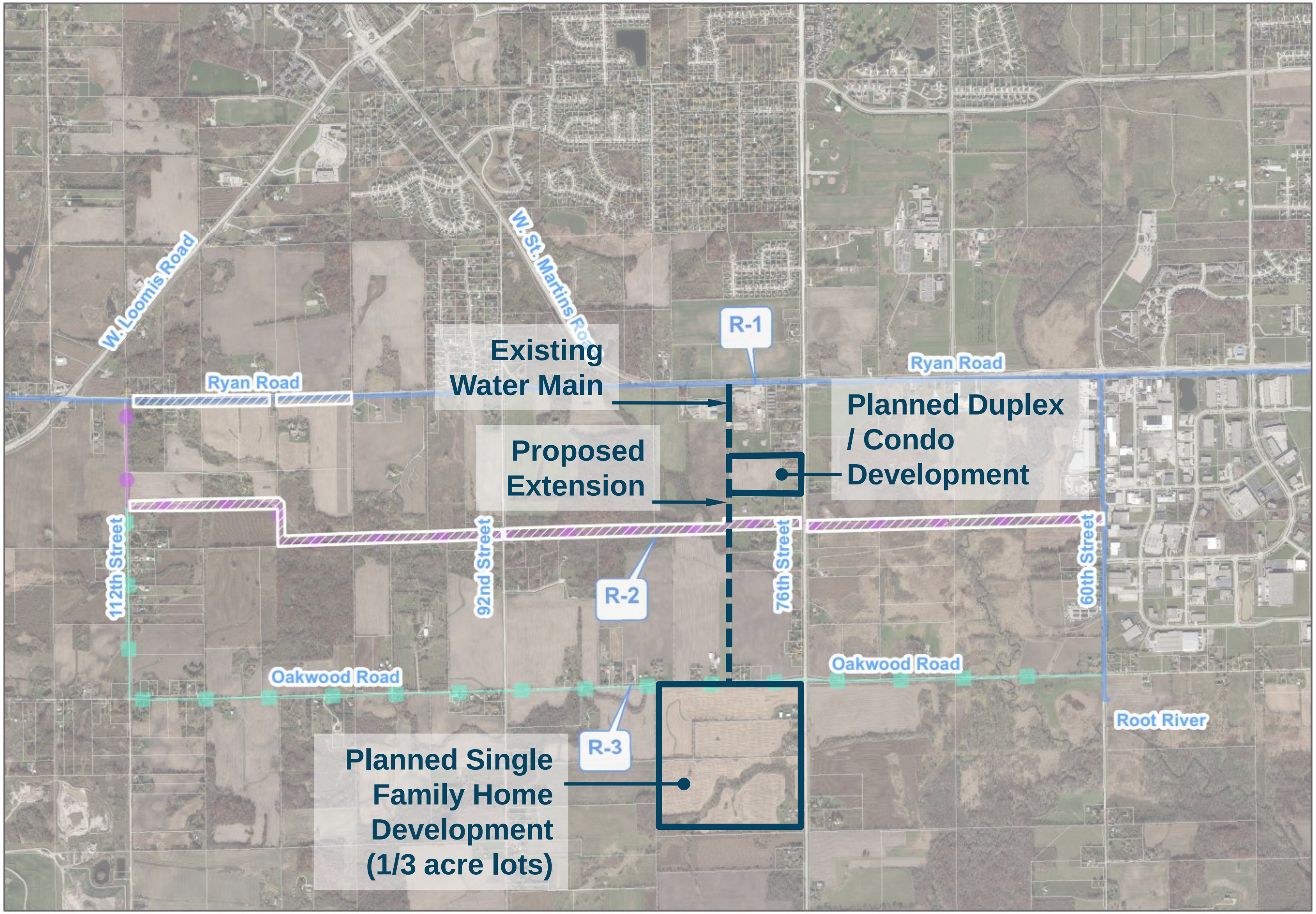
Sub-Alternative R-2 – Easement Alignment

Ryan Road: Sub-Alternatives Developed



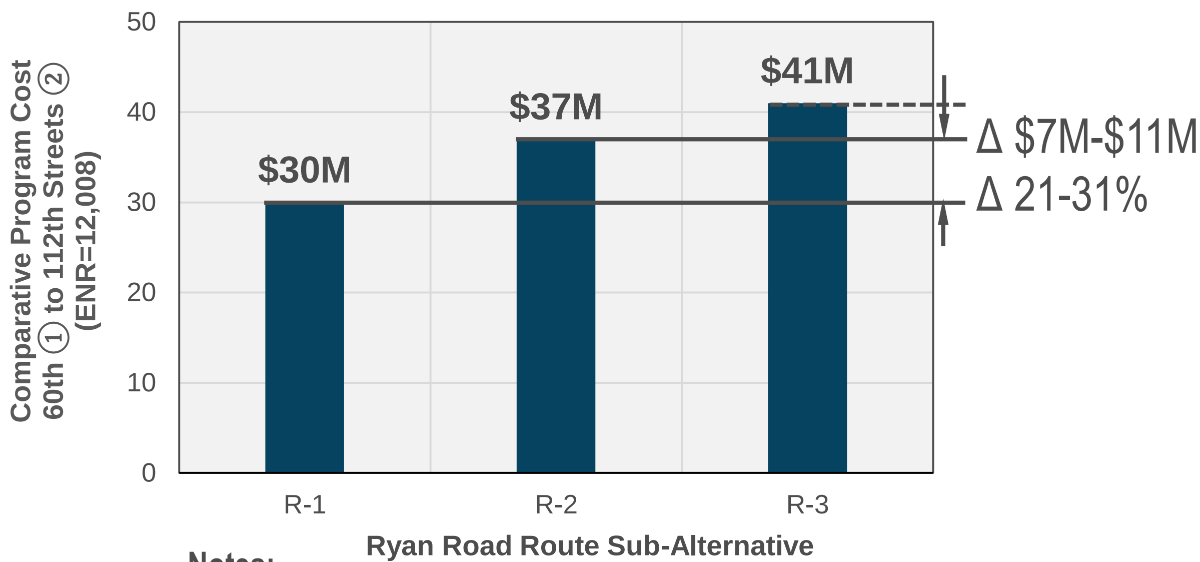
Sub-Alternative R-3 – Oakwood Road Alignment

Ryan Road: Planned Development



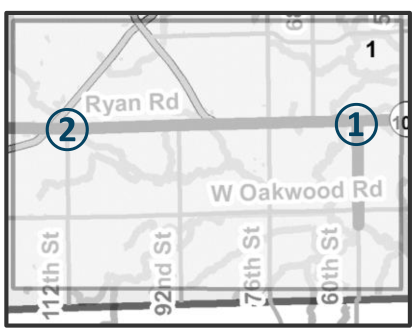
Ryan Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th ① to 112th Streets ②			
	Ryan Road Sub-Alternative		
Evaluation Item	R-1	R-2	R-3
Comparative Cost[(1)]	$30M	$37M	$41M



Notes:
1. Comparative cost shown without contingency.
2. ENR CCI = 12,008

Key Map:



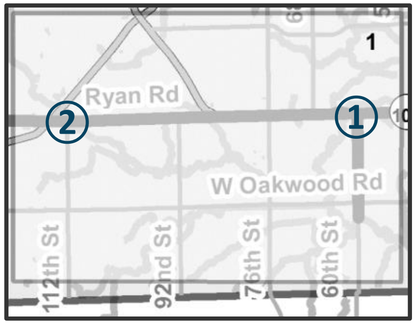
Waukesha Water Utility GREELEY AND HANSEN

Ryan Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th ① to 112th Streets ②			
	Ryan Road Sub-Alternative		
Evaluation Item	R-1	R-2	R-3
Comparative Cost	$30M	$37M	$41M
Total Pipeline Length	7.5 mi	8.5 mi	9.5 mi
Traffic	Lower	-	Lower
No. of Easements	8	11	0
Easement Length	0.7 mi	3.2 mi	0.0 mi
Potential Wetland Impacts	Moderate	Higher	Lower
Accessibility	Good	Poor	Fair
Opportunities	-	-	Development

Not preferred based on easement requirements, potential wetland impacts (schedule), and accessibility

Key Map:



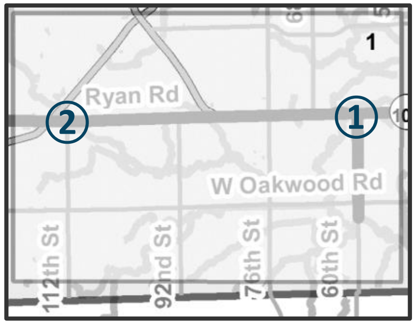
Waukesha Water Utility

GREELEY AND HANSEN

Ryan Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th ① to 112th Streets ②			
	Ryan Road Sub-Alternative		
Evaluation Item	R-1	R-2	R-3
Comparative Cost	$30M	$37M	$41M
Total Pipeline Length	7.5 mi	8.5 mi	9.5 mi
Traffic	Lower	-	Lower
No. of Easements	8	11	0
Easement Length	0.7 mi	3.2 mi	0.0 mi
Potential Wetland Impacts	Moderate	Higher	Lower
Accessibility	Good	Poor	Fair
Opportunities	-	-	Development

Key Map:



Sub-Alternative R-1

Pros	Cons
• Length • Cost • Schedule	• Potential wetland impacts • Easements

Sub-Alternative R-3

Pros	Cons
• No Easements • No Wetland impacts • Opportunities	• Length • Cost • Schedule • Floodplain Permitting

Waukesha Water Utility

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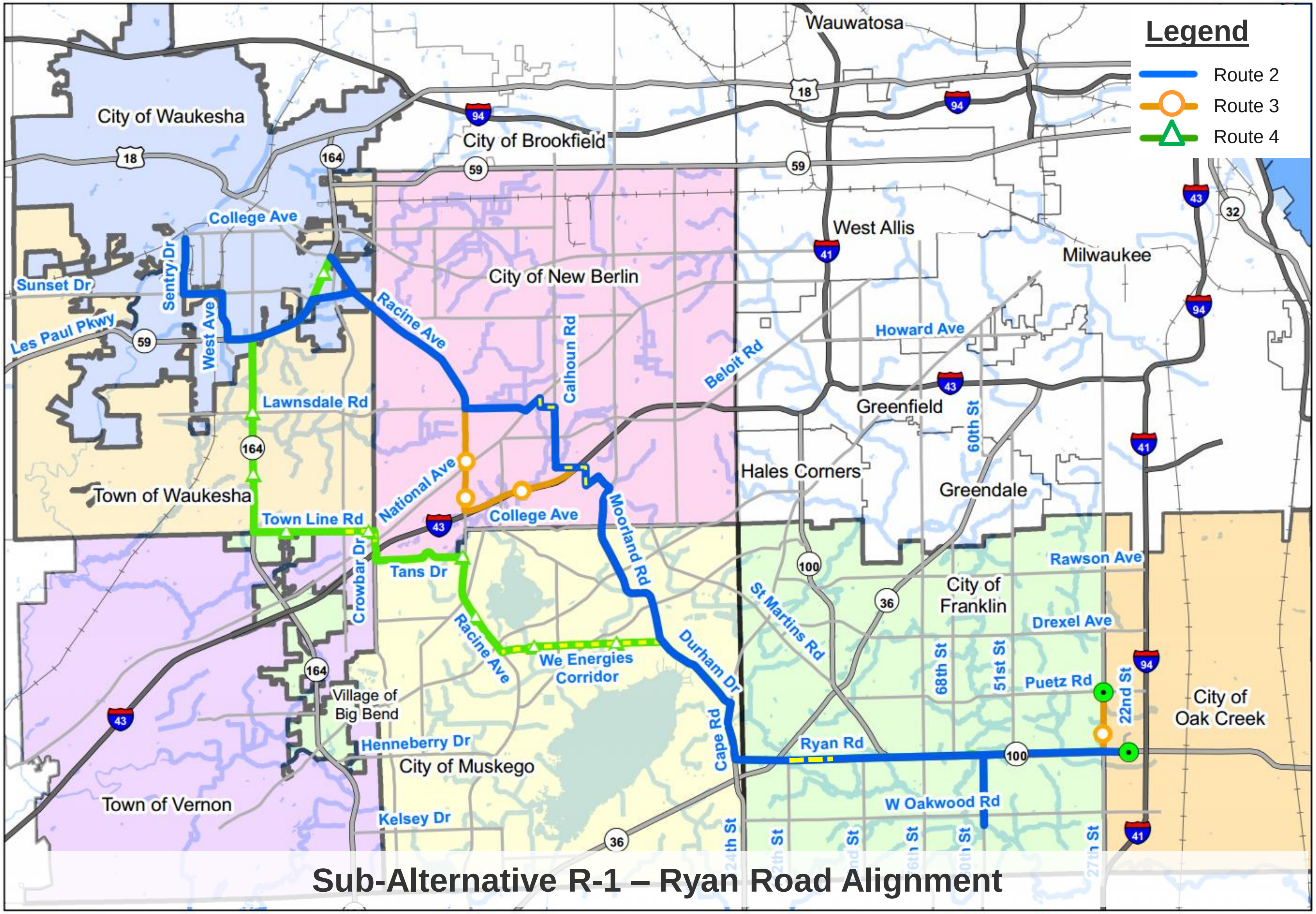
Ryan Road: Preferred Route



Sub-Alternative R-1 – Ryan Road Alignment

Introduction to Envision

What Types of Infrastructure Will Envision Rate?

ENERGY

- Geothermal
- Hydroelectric
- Nuclear
- Coal
- Natural Gas
- Oil/Refinery
- Wind
- Solar
- Biomass

WATER

- Potable water distribution
- Capture/Storage
- Water Reuse
- Storm Water
- Management
- Flood Control

WASTE

- Solid waste
- Recycling
- Hazardous Waste
- Collection & Transfer

TRANSPORT

- Airports
- Roads
- Highways
- Bikes
- Pedestrians
- Railways
- Public Transit
- Ports
- Waterways

LANDSCAPE

- Public Realm
- Parks
- Ecosystem Services
- Natural Infrastructure

INFORMATION

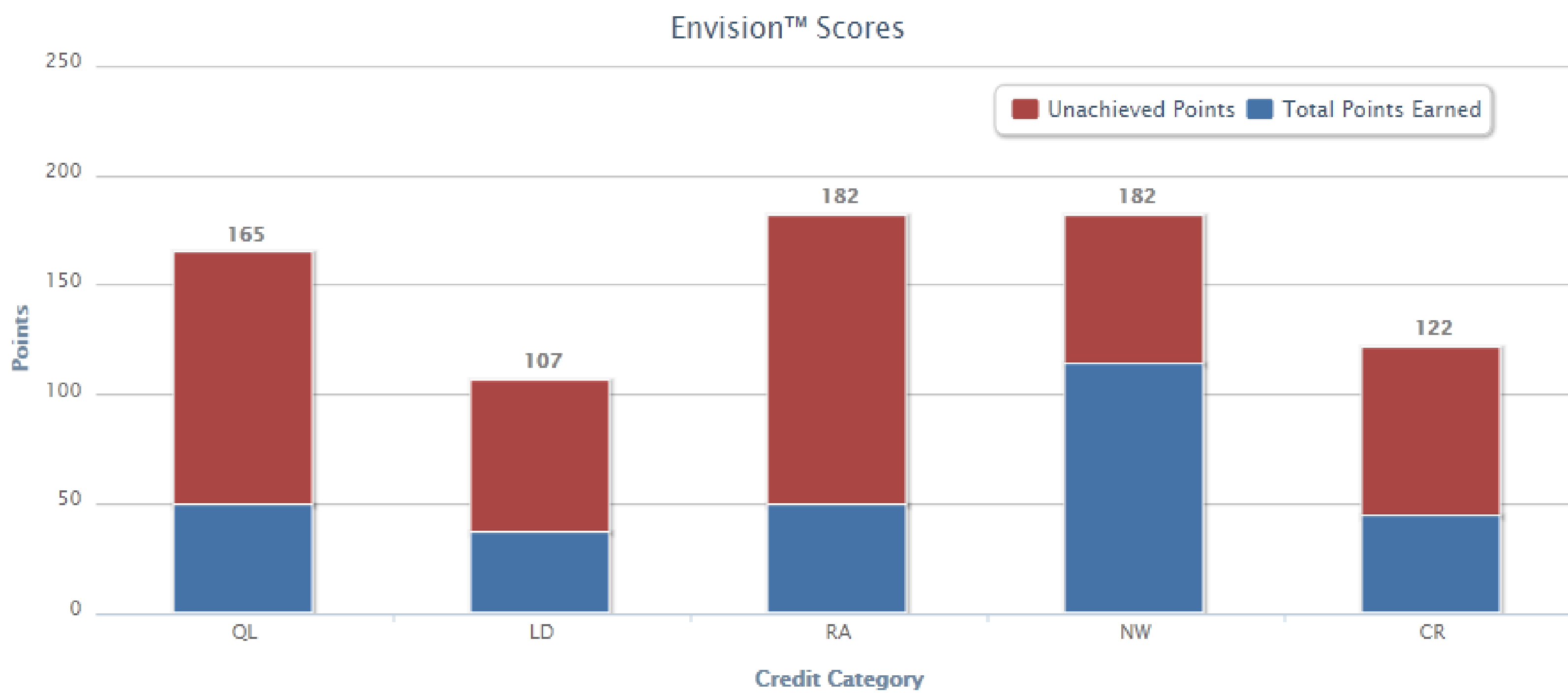
- Telecom
- Internet
- Phones
- Satellites
- Data Centers
- Sensors

60 Credits in 5 Categories

QUALITY OF LIFE	Purpose, Community, Wellbeing
LEADERSHIP	Collaboration, Management, Planning
RESOURCE ALLOCATION	Materials, Energy, Water
NATURAL WORLD	Siting, Land and Water, Biodiversity
CLIMATE AND RISK	Emission, Resilience

Scoring Summary

Credit Category	Applicable Points	Points	Innovation Points	Total Points Pursued	Percentage of Available Points
QUALITY OF LIFE	165	45	5	50	27%
LEADERSHIP	107	31	6	37	29%
RESOURCE ALLOCATION	182	50	0	50	27%
NATURAL WORLD	182	114	0	114	63%
CLIMATE AND RISK	122	45	0	45	37%
Total Workbook Points	758	285	11	296	38%



Waukesha Water Utility

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Award Levels

Minimum Percentage of Points Achieved:

20%

30%

40%

50%

Benefits of Envision for WWU

Why Use Envision?

- Incorporate Sustainable Philosophies
- Quantify Direct and Indirect Benefits to the Community
- Apply a Consistent, Transparent Approach
- Benchmark and Track Infrastructure Performance
- Achieve Additional Recognition of the Project's Commitment to Sustainability

Envision analysis and the investment process

Environmental Analysis Reveals:

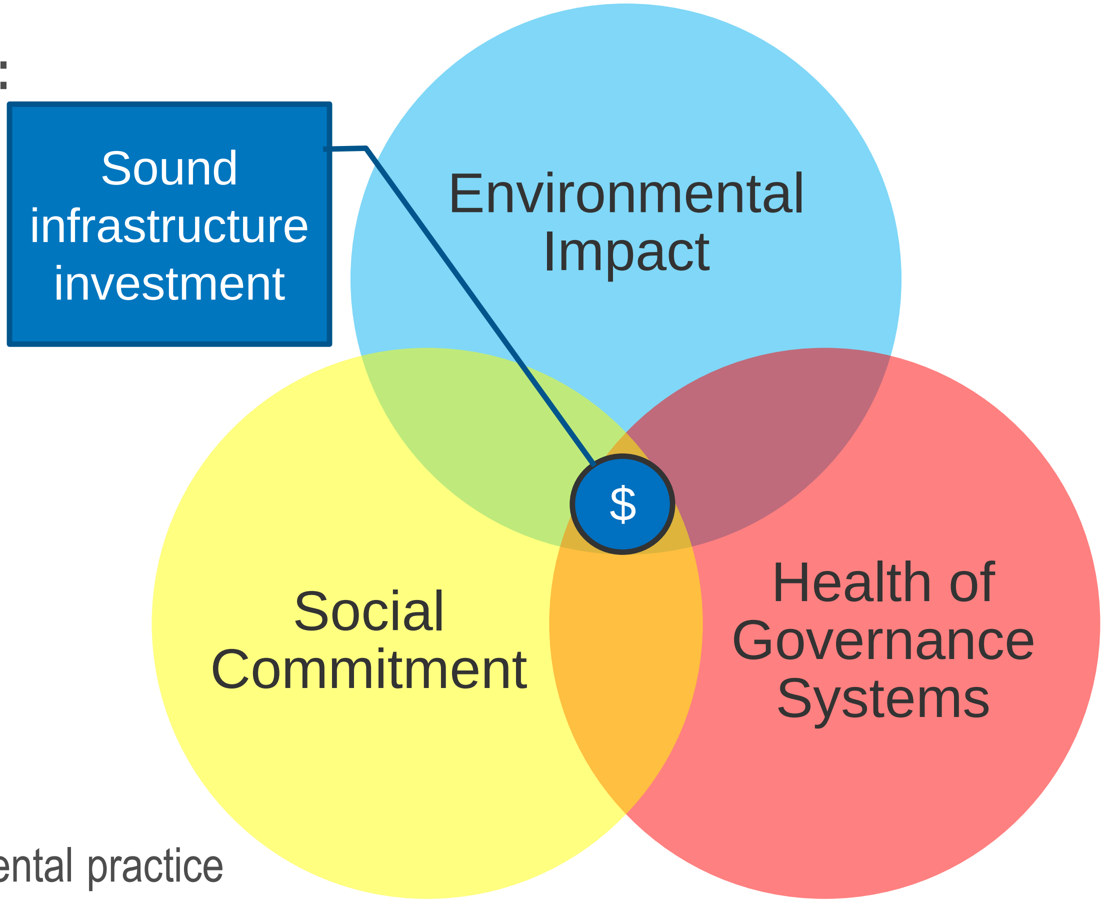
- Vulnerability to regulatory change
- Preparedness for climate change
- Adaptability to resource scarcity

Social Analysis Reveals:

- Health and Safety of Supply Chain
- Commitment to community values
- Reputational Risk

Governance Analysis Reveals:

- Strength of management systems
- Commitment to social and environmental practice
- Alignment to equality and transparency



Use of Envision in Route Study and the Great Water Alliance

WWU Route Study Weighted Criteria

Evaluation Criteria	Weight
System Reliability	10.0
Life Cycle Cost	8.0
Schedule	7.0
Ease of Construction	5.7
Public Acceptability	3.3
Capital Cost	3.0
Operations	3.0
Future Connections	3.0
Ability to Finance	3.0
Environmental Impact	2.7
Cost Sharing Potential	2.7

WWU Criteria aligned to Envision

ENVISION CREDITS

WWU CRITERIA

WWU Criteria	Quality of Life												
	1.1	1.2	1.3	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	0.0
Cost				Y		Y							
Schedule	Y												
Operations	Y												
Future Connections	Y	Y		Y									
Environmental Impacts					Y	Y		Y			Y		
Public Acceptability	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
System Reliability	Y												
Ease of Construction	Y			Y					Y				
Life-Cycle Cost		Y				Y	Y	Y				Y	Y
Cost Sharing Potential	Y	Y	Y				Y	Y	Y			Y	
Ability to Finance	Y		Y		Y	Y	Y		Y	Y	Y		

WWU Criteria	Leadership									
	1.1	1.2	1.3	1.4	2.1	2.2	3.1	3.2	3.3	0.0
Cost	Y	Y	Y			Y				
Schedule	Y		Y			Y		Y		
Operations	Y		Y		Y	Y	Y	Y	Y	
Future Connections	Y		Y	Y		Y		Y	Y	
Environmental Impacts	Y	Y		Y	Y	Y	Y		Y	Y
Public Acceptability				Y		Y	Y	Y		
System Reliability			Y				Y		Y	
Ease of Construction			Y	Y		Y		Y		
Life-Cycle Cost		Y			Y	Y	Y		Y	Y
Cost Sharing Potential			Y	Y						
Ability to Finance						Y	Y		Y	

WWU Criteria	Resource Allocation													
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	3.1	3.2	3.3	0.0
Cost					Y	Y					Y	Y		
Schedule														
Operations								Y				Y	Y	
Future Connections										Y				
Environmental Impacts	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Public Acceptability		Y	Y	Y		Y			Y		Y		Y	
System Reliability										Y			Y	
Ease of Construction						Y					Y			
Life-Cycle Cost					Y		Y	Y		Y	Y	Y	Y	Y
Cost Sharing Potential														
Ability to Finance										Y	Y		Y	

WWU Criteria	Natural World														
	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.1	2.2	2.3	3.1	3.2	3.3	3.4	0.0
Cost	Y	Y		Y	Y	Y								Y	
Schedule															
Operations								Y	Y						
Future Connections															
Environmental Impacts	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Public Acceptability	Y	Y			Y					Y	Y	Y		Y	
System Reliability				Y	Y	Y			Y	Y					
Ease of Construction	Y	Y		Y	Y	Y	Y	Y		Y				Y	Y
Life-Cycle Cost				Y	Y	Y		Y	Y						Y
Cost Sharing Potential							Y			Y					
Ability to Finance	Y			Y	Y		Y	Y	Y	Y	Y		Y	Y	

WWU Criteria	Climate and Risk							
	1.1	1.2	2.1	2.2	2.3	2.4	2.5	0.0
Cost				Y				
Schedule				Y				
Operations	Y	Y	Y	Y	Y	Y		
Future Connections								
Environmental Impacts	Y	Y					Y	
Public Acceptability		Y						
System Reliability			Y		Y	Y		
Ease of Construction								
Life-Cycle Cost	Y	Y	Y	Y	Y	Y		Y
Cost Sharing Potential								
Ability to Finance				Y		Y		

Alignment between WWU Route Study Weighted Criteria and Envision Credits

GWA Key Performance Indicators

KPI	Proposed Route Study Metric	Triple Bottom Line Dimension
Reliability	Maximum Pressure	Economic
Life Cycle Cost	Net present value over 100 years	Economic / Environmental
Schedule	Days of Construction in the Right of Way, Days after Consent Decree	Economic / Social
Ease of Construction	Qty of Special Crossings, Length of Pipe, Qty of Utility Conflicts, Qty of Directional Borings, Urban/Rural	Economic / Environmental / Social
Public Acceptance	Community Feedback / Survey	Social
Capital Cost	Value of initial investment	Economic
Operational	Increase in operational or design configurations	Social / Economic
Future Connections	Ease of installing future connections	Economic / Social
Effect on ability to finance	Envision Rating Score	Economic / Social
Environmental Impact	Tons CO2, GWP, eutrophication potential, acreage disturbed	Environmental
Cost Sharing potential	Value of CIPs along route	Economic / Social

Triple Bottom Line Evaluator

Great Water Alliance - Waukesha Water Utility
Draft Triple Bottom Line (TBL) Evaluation
May 9, 2017

Instructions:		
Modify only orange shaded cells		
1.	Weigh TBL categories depending on relative importance of Schedule, Public Acceptability, etc. (cells C16-C71). Sum of the values must be equal to 100.	OK
2.	Weigh subcategories depending on relative importance (orange highlighted cells in column D). Sum of three values under each major category must be equal to 30. Place values only in orange highlighted cells.	
3.	Score each alternative with a value of 1 through 5 depending on how well it is expected to achieve the associated criteria in column C (cells H19-R62). Place values only in orange highlighted cells. A value of 1 is not expected to meet the criteria at all and a value of 5 is expected to meet the criteria ideally.	

	Criteria	Actual Weights [1]	Maximum Possible Score	Potential Route Alternatives							
				Alternative 1: Route 2 (primary)	Alternative 2: Route 2 (sub alternate)	Alternative 3: Route 3 (primary)	Alternative 4: Route 3 (sub alternate)	Alternative 5: Route 4 (primary)	Alternative 6: Route 4 (sub alternate)	Alternative 7: Alternative Route (primary)	Alternative 8: Alternative Route (sub alternate)
1	***Social and Community Goals***										
1.1	*Schedule*	*14.0*	*5*	3	4	4	4	3	3	4	4
1.1.1	Design mandated days until project completion										
1.1.2	Design mandated days of construction										
1.1.3	Design mandated days for Right-of-Way occupying construction										
1.1.4	Avoid designs and sites that are vulnerable to schedule extending conditions										
1.2	*Public Acceptability*	*6.5*	*5*	3	3	4	5	5	3	3	5
1.2.1	Approval of the community and other stakeholders										
1.2.2	Solutions to issues raised by stakeholders										
1.2.3	Jobs created and skillsets cultivated by the project										
1.2.4	Impact on industries' interest in the region as a direct or indirect result of the project										
1.2.5	Contributions to stakeholders' desired infrastructure (public spaces, renovated roads, etc.)										
1.2.6	Minimize inconveniences and negative impacts on the community										
1.3	*Operations*	*6.0*	*5*	5	4	4	4	3	4	5	5
1.3.1	Number of vulnerabilities and hazards accounted for in construction and design										
1.3.2	Number of parameters designed to meet more stringent regulations than currently exist										
1.3.3	Adaptability of the design to operate in a variety of social, economic, and environmental conditions										
1.3.4	Long-term monitored systems that ensure ease and consistency of operation										
1.4	*Future Connections*	*6.0*	*5*	5	4	4	4	3	4	5	5
1.4.1	Ability to add future connections										
2	***Economic Goals***										
2.1	*System Reliability*	*19.0*	*5*	1	5	4	4	2	3	4	3
2.1.1	Expected frequency of maintenance										
2.1.2	Long-term monitored systems that ensure efficient and sustainable performance										
2.1.3	Avoidance of sites that pose a risk to the project's operation long-term										
2.1.4	Designs to mitigate potential hazards and environmental degradations										
2.2	*Life Cycle Cost*	*15.5*	*5*	1	5	4	5	1	4	5	3
2.2.1	Stimulate sustainable growth and development										
2.2.2	Direct and indirect contributions to improvements in public health (public space)										
2.2.3	Implement cost alleviating by-product synergy opportunities										
2.2.4	Extend the useful life of the project										
2.2.5	Sustainable designs that reduce waste production and resources consumption										
2.3	*Ease of Construction*	*11.0*	*5*	4	3	3	3	3	4	5	4
2.3.1	Accessibility of the sites										
2.3.2	Infrastructure integration to minimize construction effort required										
2.3.3	Site selection requiring minimal regulations regarding restoration, disturbance, and hazard mitigation										
2.4	*Capital Cost*	*6.0*	*5*	4	4	3	4	3	4	5	3
2.4.1	Overall capital cost										
2.4.2	Efficiency in design and construction										
2.4.3	Sustainable cost savings mechanisms in the design and in the construction specifications										
2.4.4	Site selection requiring minimal expenses for restoration, disturbance, and hazard mitigation										
2.5	*Ability to Finance*	*6.0*	*5*	1	5	4	5	1	4	5	3
2.5.1	Project meets the ENVISION Criteria										
2.6	*Cost Sharing Potential*	*5.0*	*5*	1	5	4	5	1	4	5	3
2.6.1	Infrastructure integration such that project coincides with existing capital improvement plans										
2.6.2	Designs and public contributions within the project that benefit all stakeholders										
3	***Environmental Goals***										
3.1	*Environmental Impact*	*5.0*	*5*	5	4	3	3	2	2	5	4
3.1.1	Mitigation of impacts of construction on the natural world										
3.1.2	Mitigation of impacts of the project on ambient conditions of the community (noise, light, air quality)										
3.1.3	Process compatible with sustainability management plan										
	Design requires minimal net-embodied energy, resources consumption, and greenfields developed										
	Net TBL Score [2]	100	470	230	404	354	393	218	327	424	337
	Percent of Max Possible Score		NA	49%	86%	75%	84%	46%	69%	90%	72%

[1] Actual Weight = Relative Importance Category Weight as Percent of Total of All Categories x Sub-criteria Internal Weighing Factor as Percent of Criteria Total x Sum of Criteria Total (For Sub-criteria 1.1 = 0.20 x 0.40 x 100 = 8.0)

[2] Net TBL Score = Sum of each sub-criteria score x each Actual Weight for each Alternative

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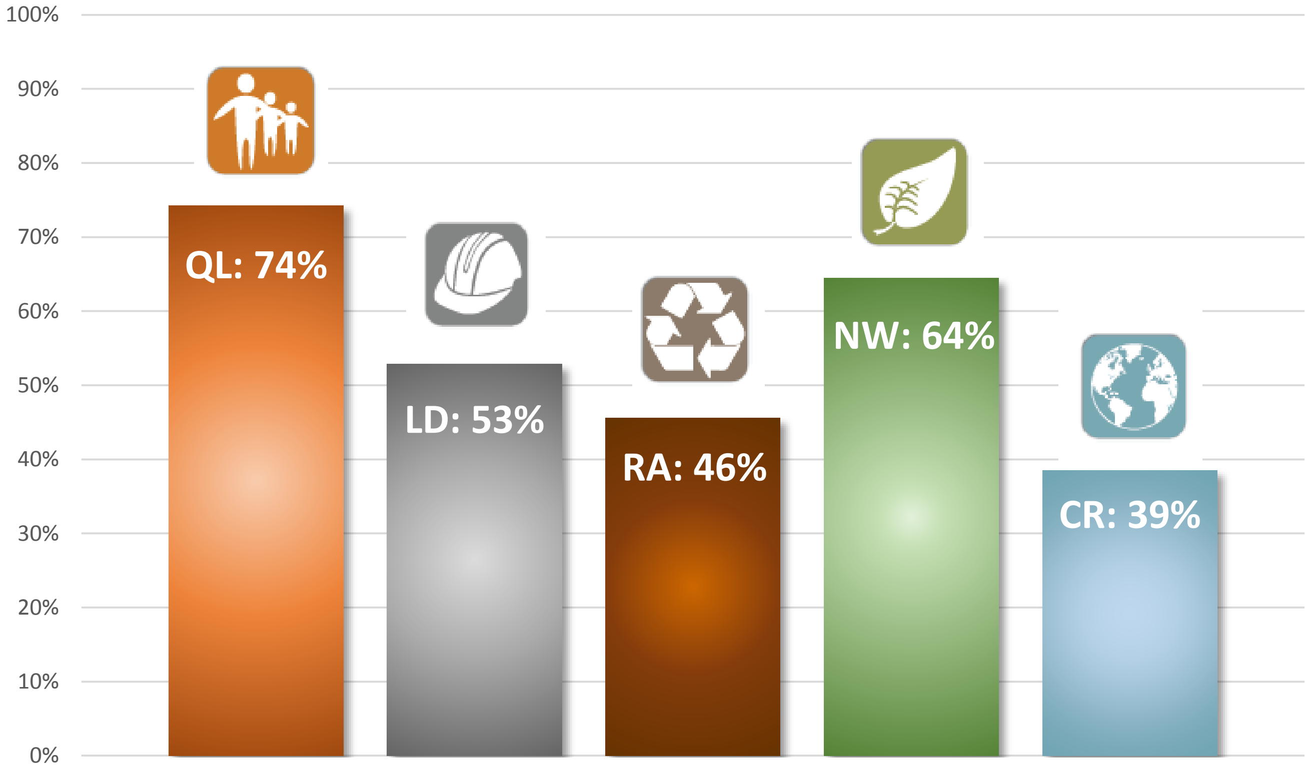
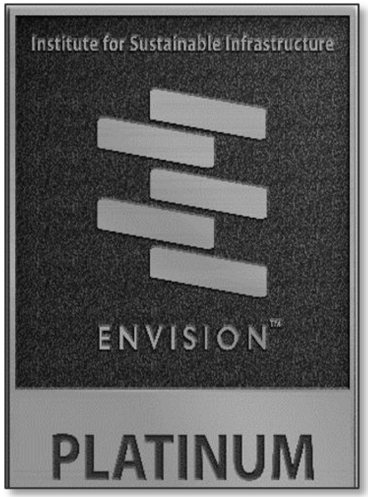
Projected Envision Score: XX%?





Summary Wrap-Up and Action Items

Summary Wrap-Up and Action Items

- Gained Consensus on the Route on Ryan Road between 60th Street and 112th Street, including the:
  - Sub-alternatives identified;
  - Sub-alternative comparison; and
  - Preferred route.
- Discussed Envision, including:
  - A general understanding of Envision,
  - A review of Envision benefits for WWU; and
  - How we apply Envision to the Route Study and the Great Water Alliance.

THANK YOU

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886
GREELEY AND HANSEN

MEETING SUMMARY

The Great Lakes Water Supply Program (Program) Route Study Meeting: Water Supply Route Development was held in the Waukesha Water Utility (WWU) Large Conference Room at 9:00 a.m. on November 30, 2017. The purpose of the meeting was to gain consensus on three route alternatives that will be evaluated as part of the Route Study: Milwaukee for the Water Supply Pipeline. The attendees are listed on the attached sign-in sheet. The agenda and presentation materials are also attached.

	Action Item	Action By	Due Date
1.	Evaluate an additional route sub-alternative along the Interstate 43 corridor between Moorland Road and Racine Avenue, Route Sub-Alternative M3-3.5. Share updated evaluation of comparison table for Route Sub-Alternatives M3-3.1 through M3-3.5 with WWU via email.	T. Bluver	**12/14/17**

1) **Welcome**
   a) The agenda, meeting objectives, and key work recently performed were discussed.

2) **Constraints**
   a) The starting and ending points of the route alternatives were identified.
      i. The starting point is at the intersection of Howard Avenue and 60th Street in Milwaukee. The starting point was identified to encompass the entire extent of infrastructure required to transition Waukesha's water supply to support documentation required by the Public Service Commission. Further discussions will proceed with Milwaukee on the connection location.
      ii. The ending point of all the route alternatives is at the anticipated location of the BPS southeast of the intersection of Racine Avenue and Swartz Road in the City of New Berlin.
   b) Planned regional transportation projects were discussed. The Program team will continue to work with local municipalities to identify recent and planned regional transportation projects.
   c) The Route Study Area is generally bounded to include Interstate 43 in the south, Minooka Park in the west, Oklahoma Avenue and Coffee Road in the north, and 60th Street in the east.
   d) The Route Study Area is separated into three separate panels, as show on exhibit handouts.

3) **60th Street to Interstate 41 (Panel 1)**
   a) Panel 1 route sub-alternatives for Route Alternatives M1, M2, and M3 were compared and discussed.
   b) Consensus was gained that the Route Study: Milwaukee will proceed utilizing Route Sub-Alternative M1-1.1 for Route Alternative M1 and Route Sub-Alternative M2-1.2 for Route Alternatives M2 and M3 as shown on Slide 55.

4) **Interstate 41 to Moorland Road (Panel 2)**
   a) Panel 2 route sub-alternatives for Route Alternative M2 were compared and discussed. Route sub-alternatives were not identified for Route Alternatives M1 and M3 on Panel 2, as any other route would extend the length at no benefit.

b) Consensus was gained that the Route Study: Milwaukee will proceed utilizing Route Sub-Alternative M2-2.4 for Route Alternative M2, and Route Alternatives M1 and M3 as shown on Slide 76.

5) Moorland Road to BPS (Panel 3)

a) Panel 3 route sub-alternatives for Route Alternatives M1, M2, and M3 were compared and discussed.

b) Consensus was gained that the Route Study: Milwaukee will proceed utilizing Route Sub-Alternatives M1-3.2, M2-3.2, and M3-3.4 as shown on Slide 96.

c) It was determined an additional route sub-alternative, aligned along the Interstate 43 corridor, will need to be evaluated and added to the comparison table shown on Slides 93-95 to be consistent with the Route Study: Oak Creek. The route sub-alternative will be named Route Sub-Alternative M3-3.5. The updated comparison table will be shared with WWU via email. If Route Sub-Alternative M3-3.5 is determined to be more preferable than Route Sub-Alternative M3-3.4, the Route Study: Milwaukee will proceed utilizing Route Sub-Alternative M3-3.5.

6) Summary Wrap-Up and Action Items

a) The Route Study: Milwaukee will proceed for Route Alternatives M1, M2, and M3 shown on Slide 98. Desktop analyses with subconsultants will be initiated on these route alternatives.

b) Key action items are summarized in the table above.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER ALLIANCE

ROUTE STUDY MEETING: WATER SUPPLY ROUTE DEVELOPMENT
SIGN-IN SHEET

November 30, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	[redacted]
3	Ted Bluver	Greeley and Hansen	[redacted]
4	Kyle Butler	Greeley and Hansen	[redacted]
5	Mike Pekkala	Greeley and Hansen	[redacted]
6	Katie Richardson	Greeley and Hansen	[redacted]
7	Nicole Spieles	Greeley and Hansen	[redacted]
8	Connor Wraight	Greeley and Hansen	[redacted]
9	Kevin Richardson	Kevin Richardson Consulting	[redacted]
10			
11			
12			

Date/Time: November 30, 2017, 9:00 a.m. – 10:30 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Kyle Butler, GH
Mike Pekkala, GH
Katie Richardson, GH
Nicole Spieles, GH
Connor Wraight, GH
Kevin Richardson, KRC

Time	Topic	Presenter(s)
9:00 a.m.	Welcome - Agenda Overview (Handout) - Meeting Objectives - Key Work Recently Performed	Nicole Spieles; Ted Bluver
9:05 a.m.	Constraints - Points of Connection - Planned Regional Transportation Projects - Route Study Area	Ted Bluver
9:15 a.m.	60th Street to Interstate 41 - Sub-Alternatives - Comparison - Routes for Further Evaluation	Kyle Butler
9:40 a.m.	Interstate 41 to Moorland Road - Sub-Alternatives - Comparison - Routes for Further Evaluation	Connor Wraight
10:00 a.m.	Moorland Road to Booster Pumping Station (BPS) - Sub-Alternatives - Comparison - Routes for Further Evaluation	Connor Wraight
10:20 a.m.	Summary Wrap-Up and Action Items	Ted Bluver
10:30 a.m.	Adjourn	

Great Lakes Water Supply Program

Great Water Alliance | Task 4-100 Meeting No. 4

Route Study Meeting: Water Supply Route Development

November 30, 2017

GREAT WATER ALLIANCE™

GREELEY AND HANSEN

Meeting Objectives

- Review the Route Development Constraints, including the:
  - Starting and ending points;
  - Planned Regional Transportation Projects; and,
  - Route Study Area.
- Gain Consensus on the Routes between 60th Street and Interstate 41, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.

Meeting Objectives (Continued)

- Gain Consensus on the Routes between Interstate 41 and Moorland Road, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.
- Gain Consensus on the Routes between Moorland Road and the BPS, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.
- Gain Consensus that DEL 4-100 D2 Route Study: Milwaukee Will Be a Standalone Document. Share Draft Outline for Review.

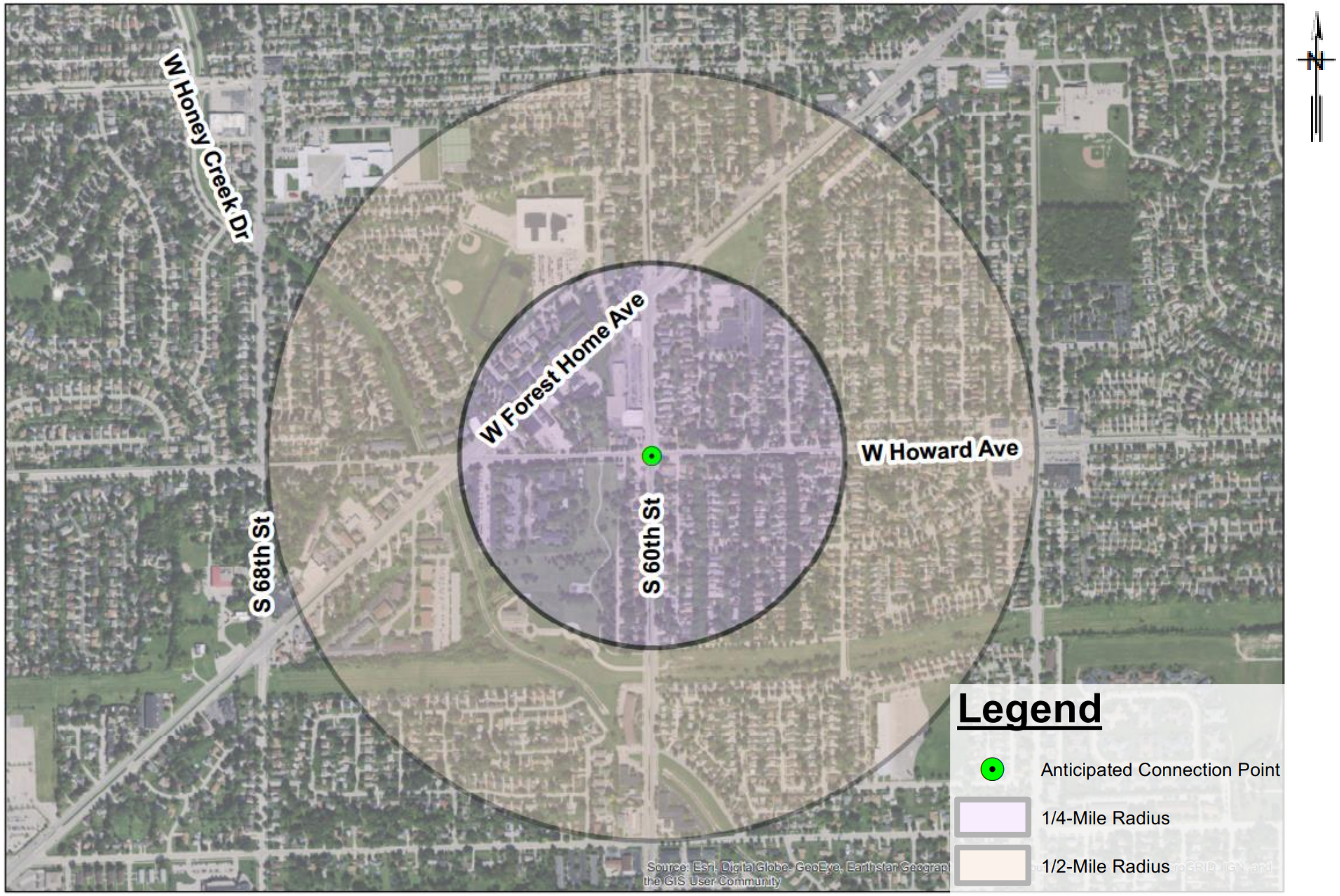
Key Work Recently Performed

- Submitted Draft Route Study: Oak Creek.
- Identified Route Sub-Alternatives between 60th Street and Interstate 41, Interstate 41 and Moorland Road, and Moorland Road and the BPS.
- Compared Route Sub-Alternatives Based on Economic and Non-Economic Analysis.
- Identified three Preferred Route Sub-Alternatives for Further Evaluation.

Constraints

Constraints: Points of Connection

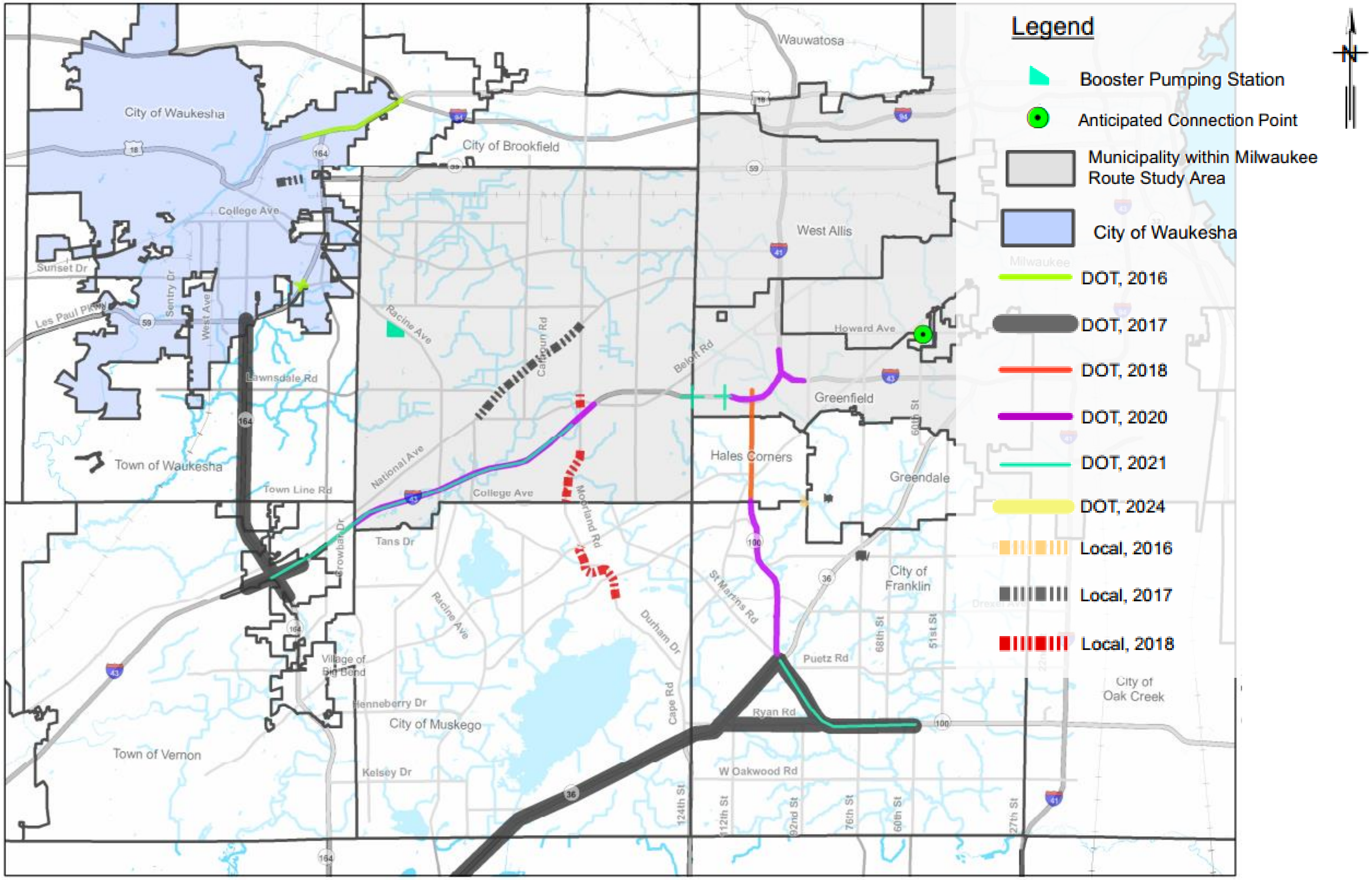
- Connection to Water Supplier (Starting Point)



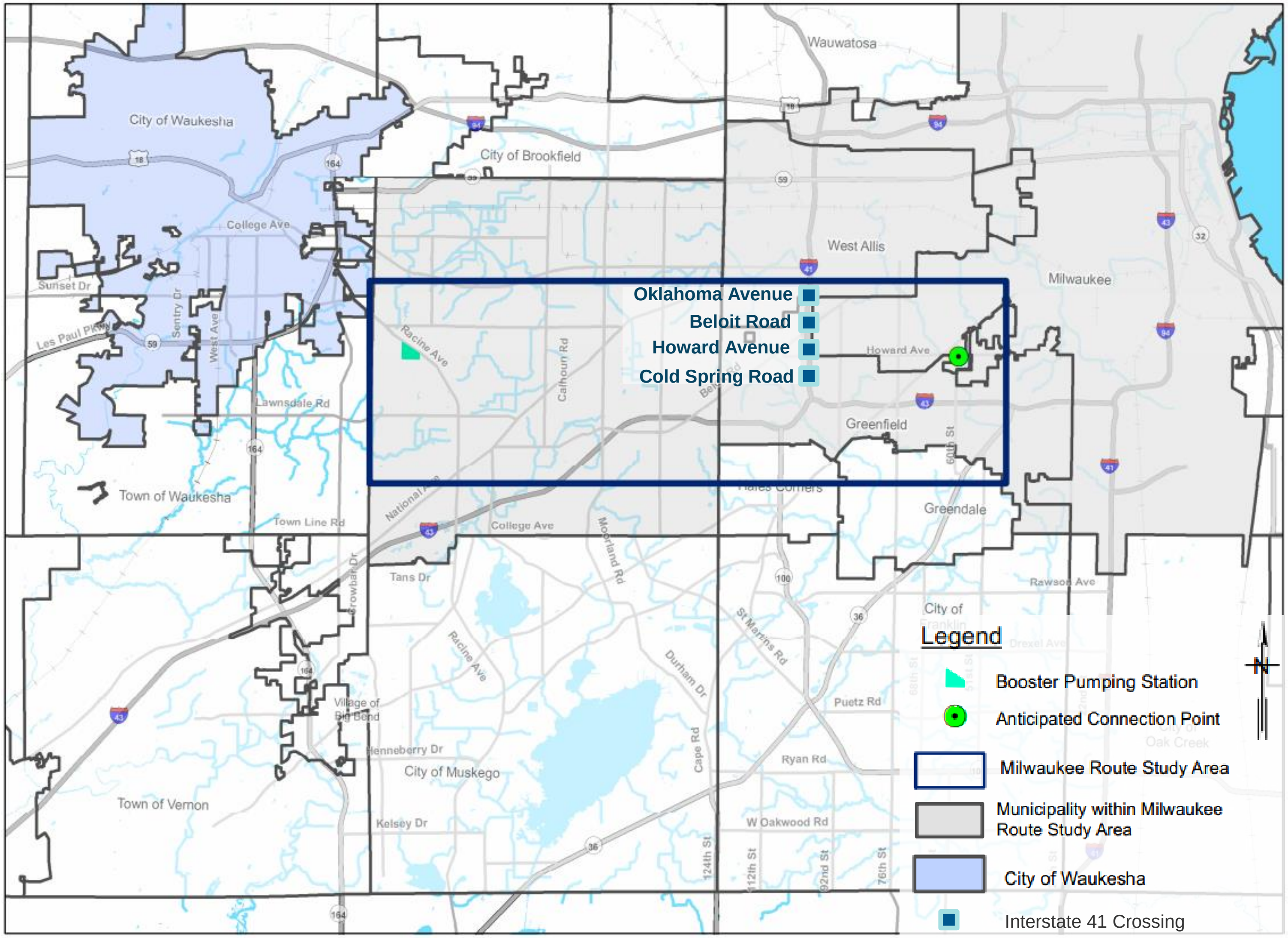
Constraints: Points of Connection

- Connection to Booster Pumping Station (BPS) (Ending Point)

Constraints:
Planned Regional Transportation Projects



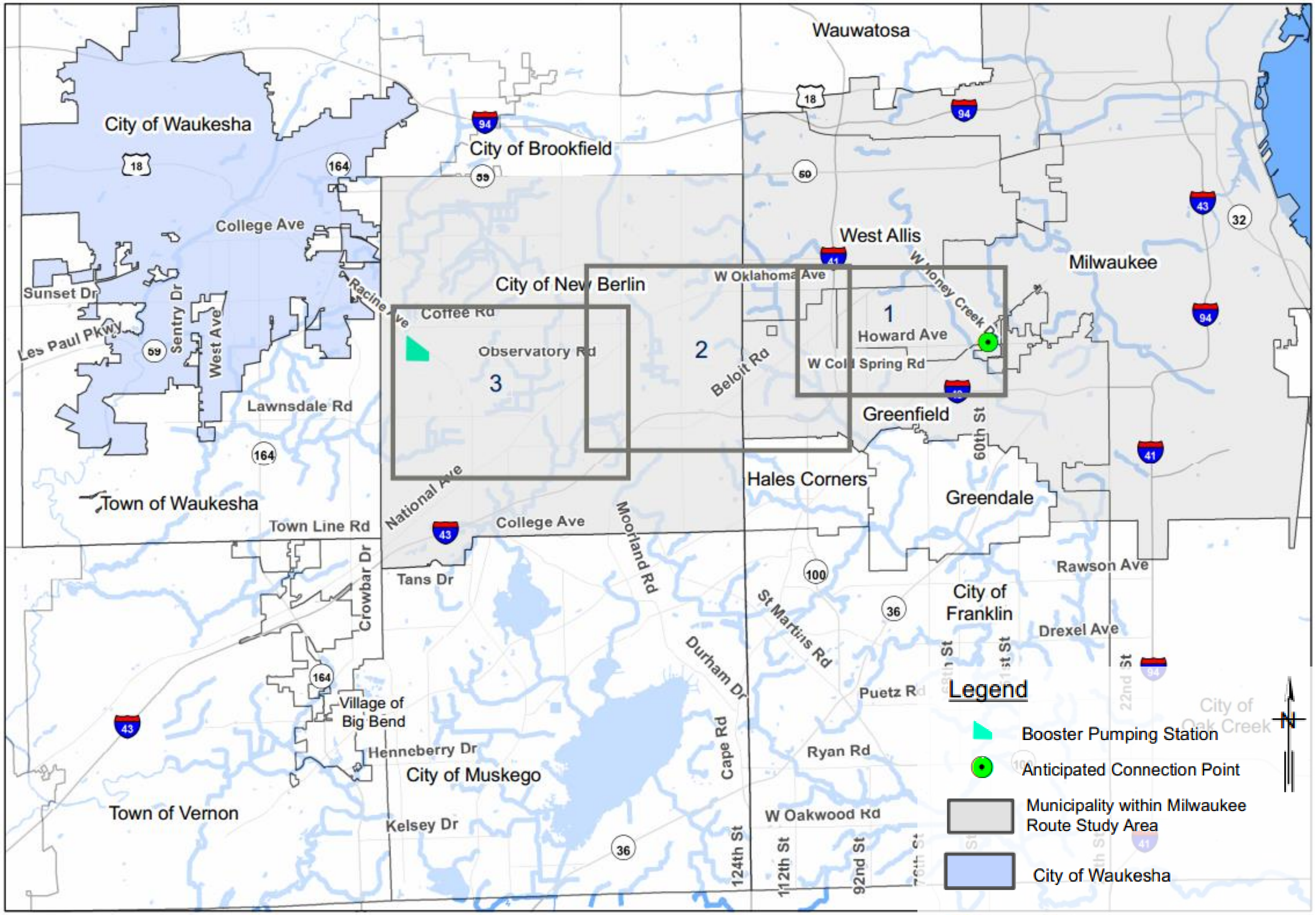
Constraints: Route Study Area



Waukesha Water Utility

GREELEY AND HANSEN

Constraints: Route Study Area

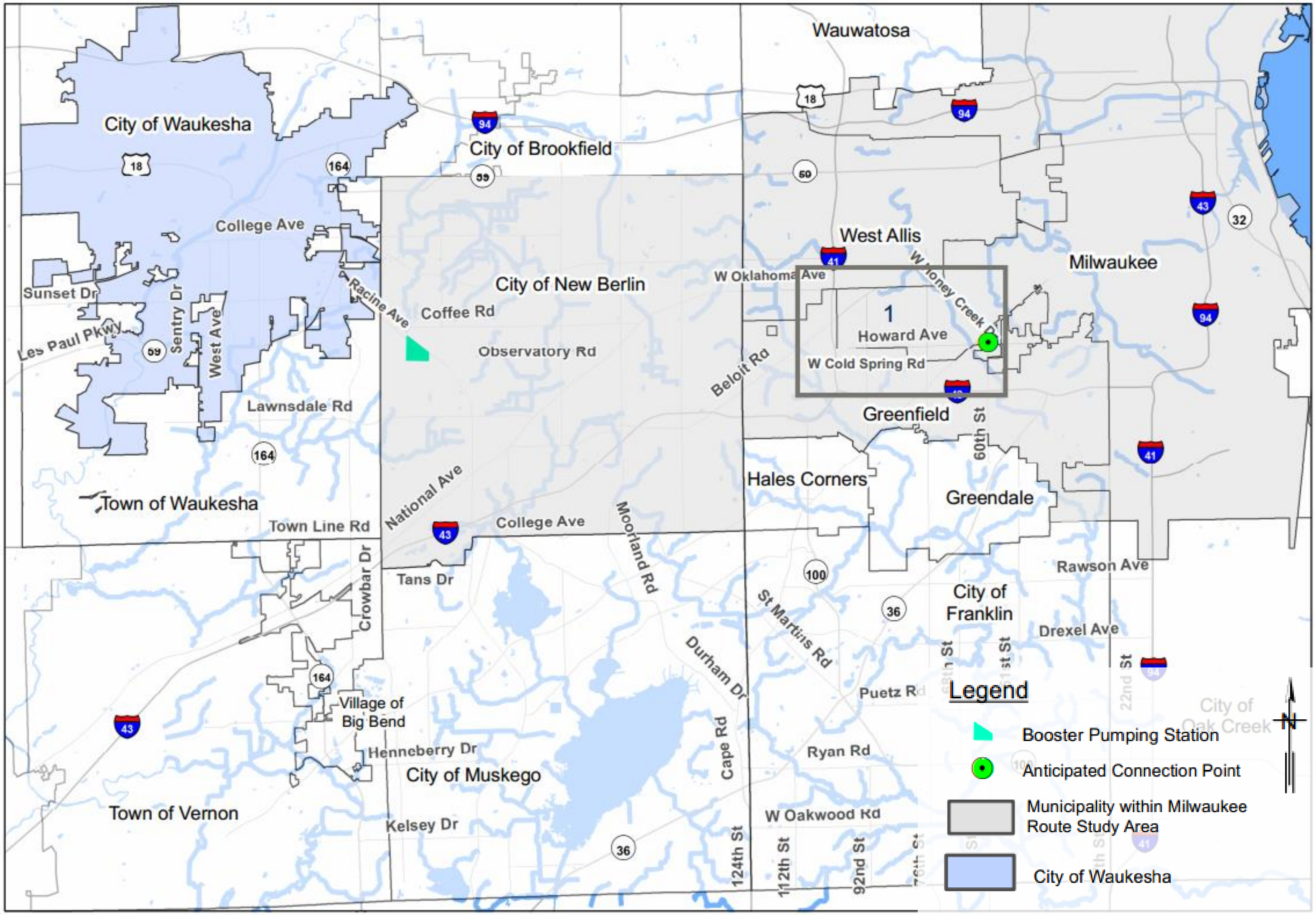


Waukesha Water Utility

GREELEY AND HANSEN

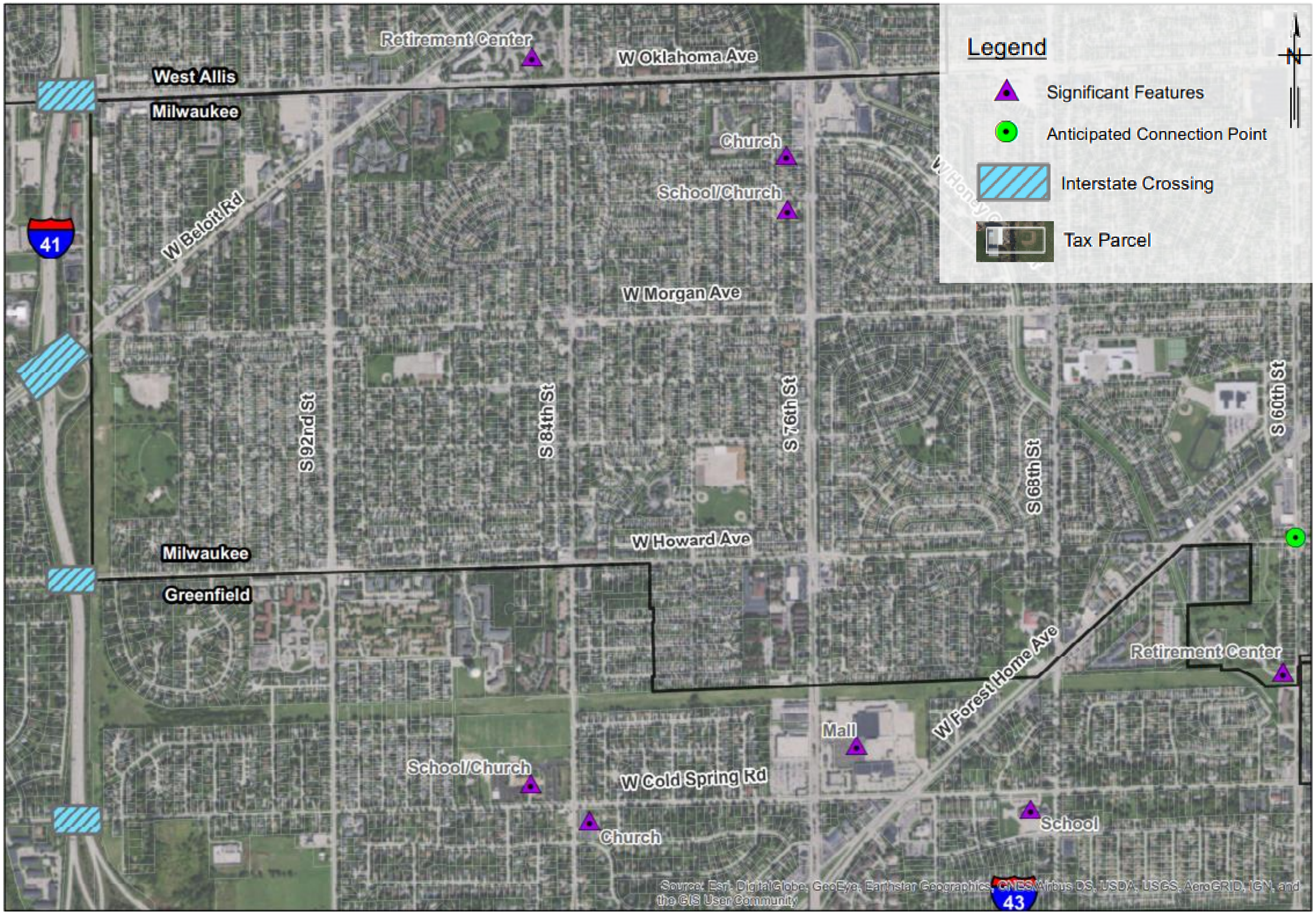
60th Street to Interstate 41

Constraints: Route Study Area



Waukesha Water Utility GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives



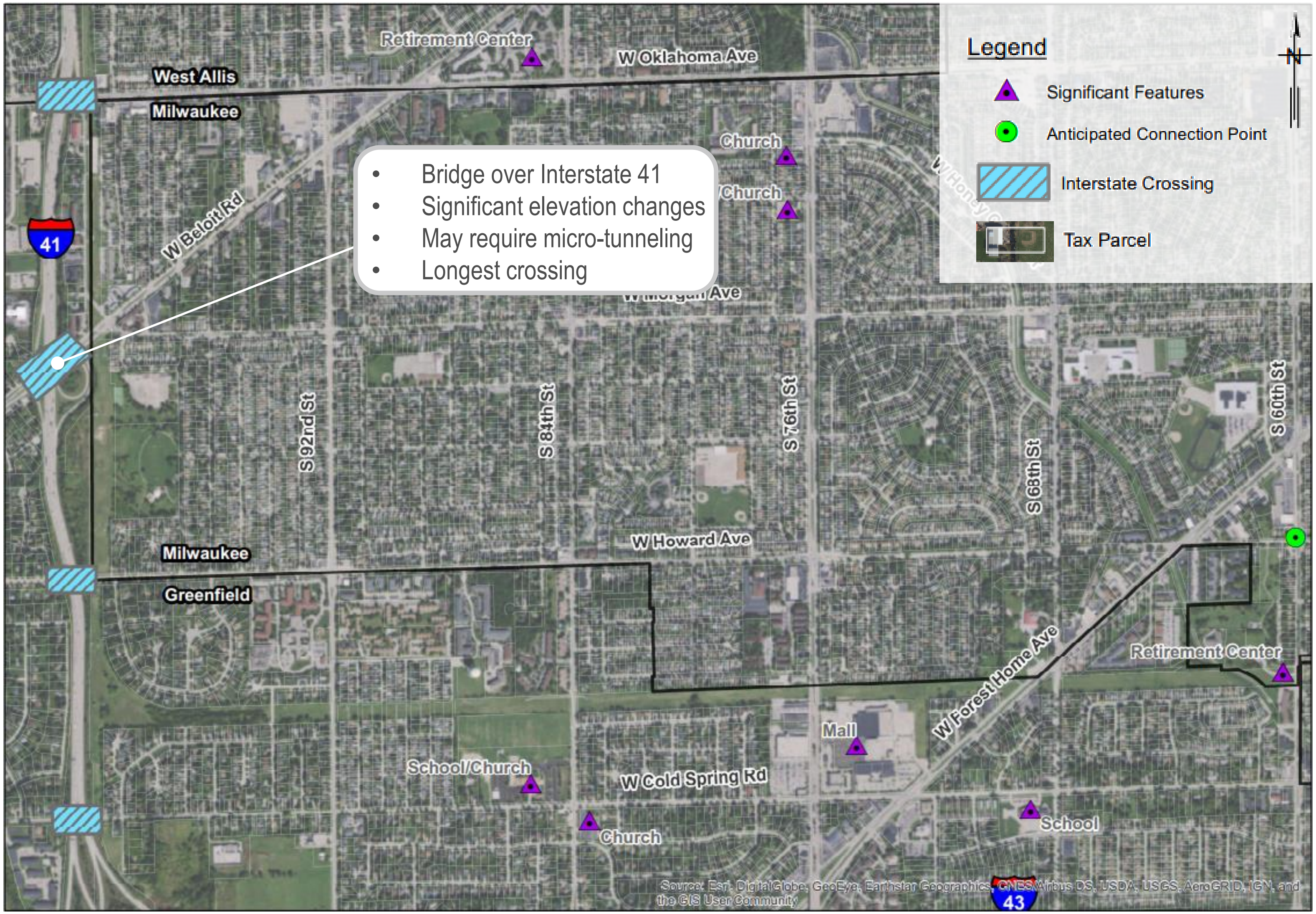
Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives

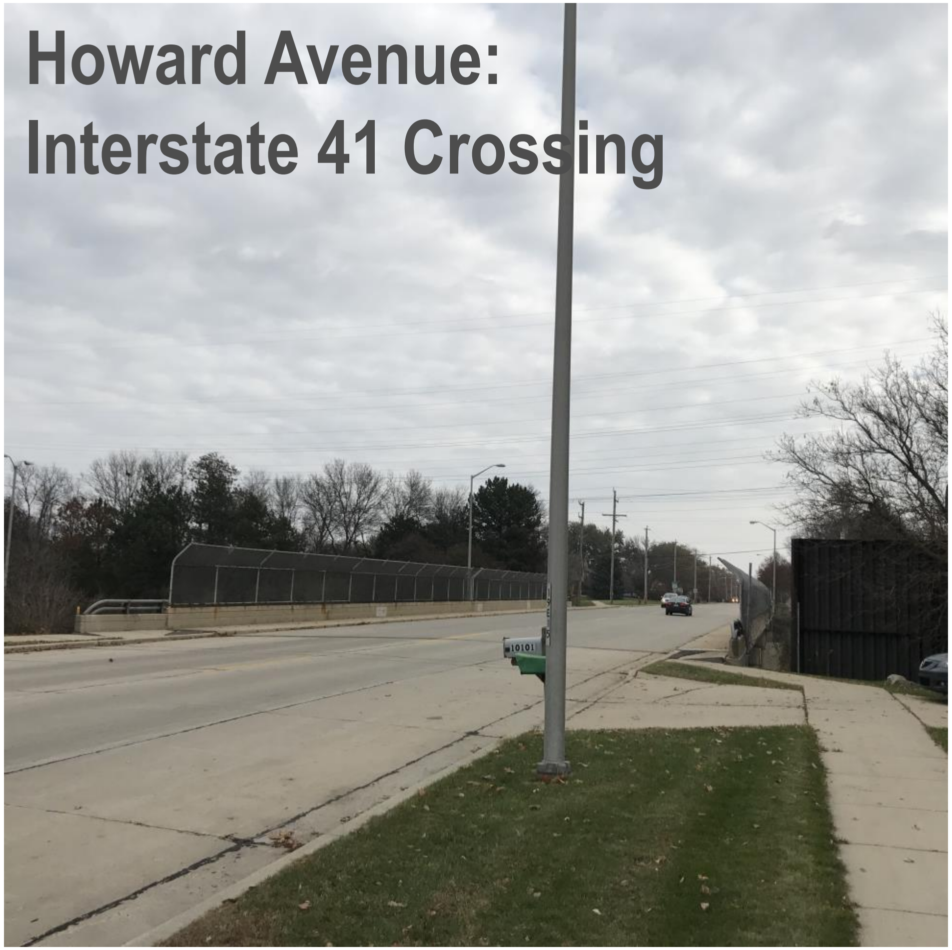
Beloit Road: Interstate 41 Crossing

60th Street to Interstate 41: Sub-Alternatives

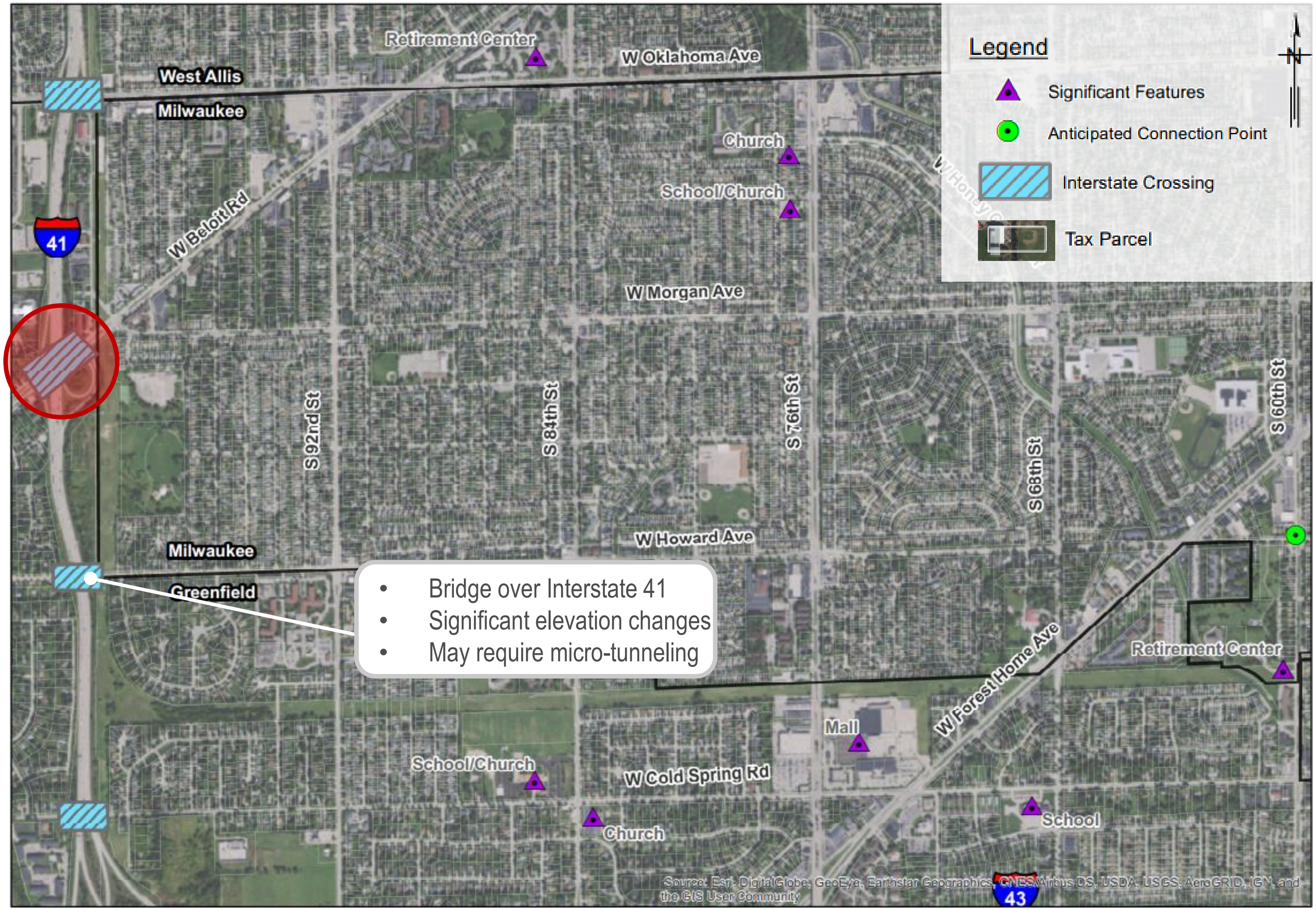


60th Street to Interstate 41: Sub-Alternatives

Howard Avenue: Interstate 41 Crossing



60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives

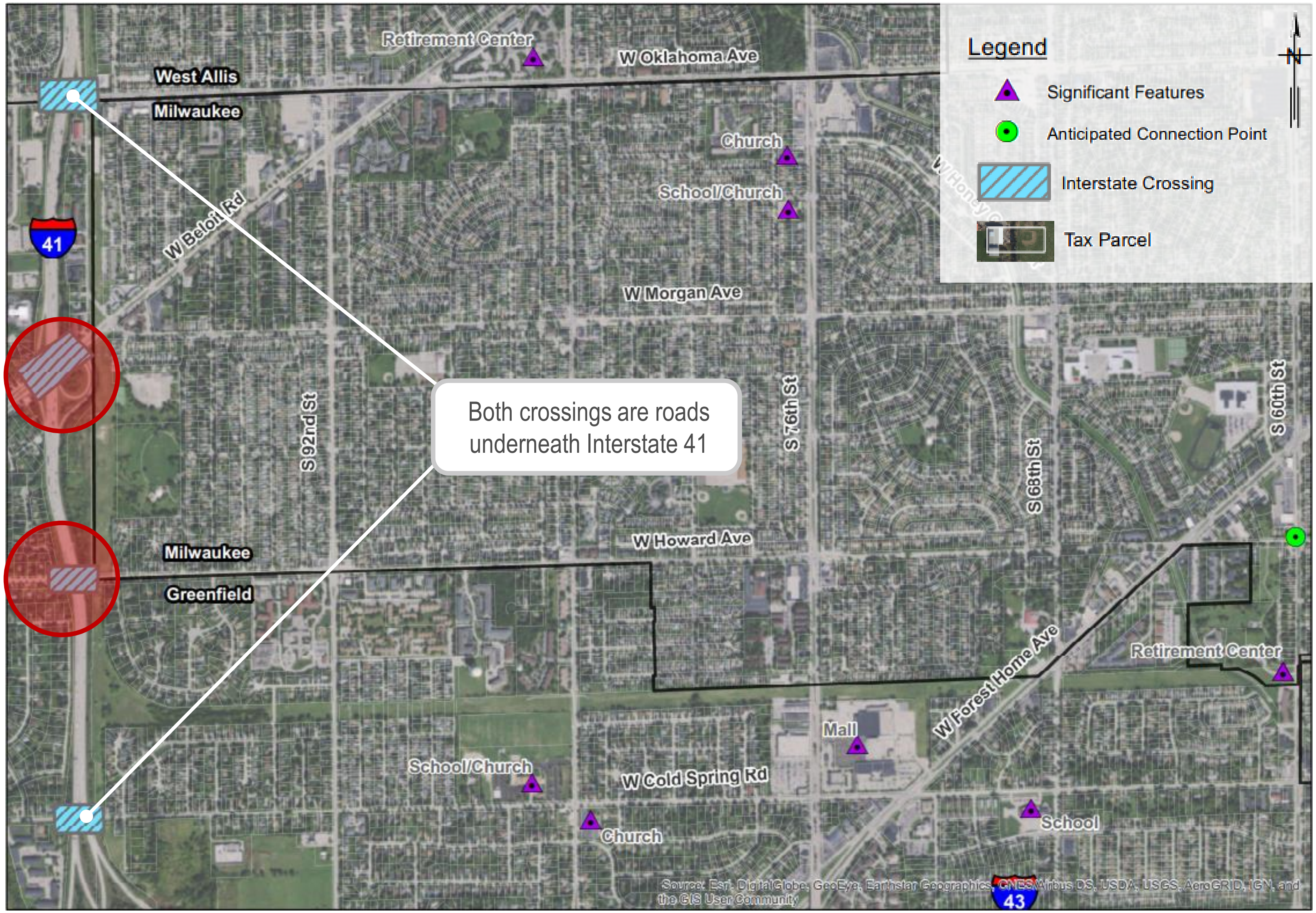
Oklahoma Avenue: Interstate 41 Crossing

Waukesha Water Utility

GREELEY AND HANSEN

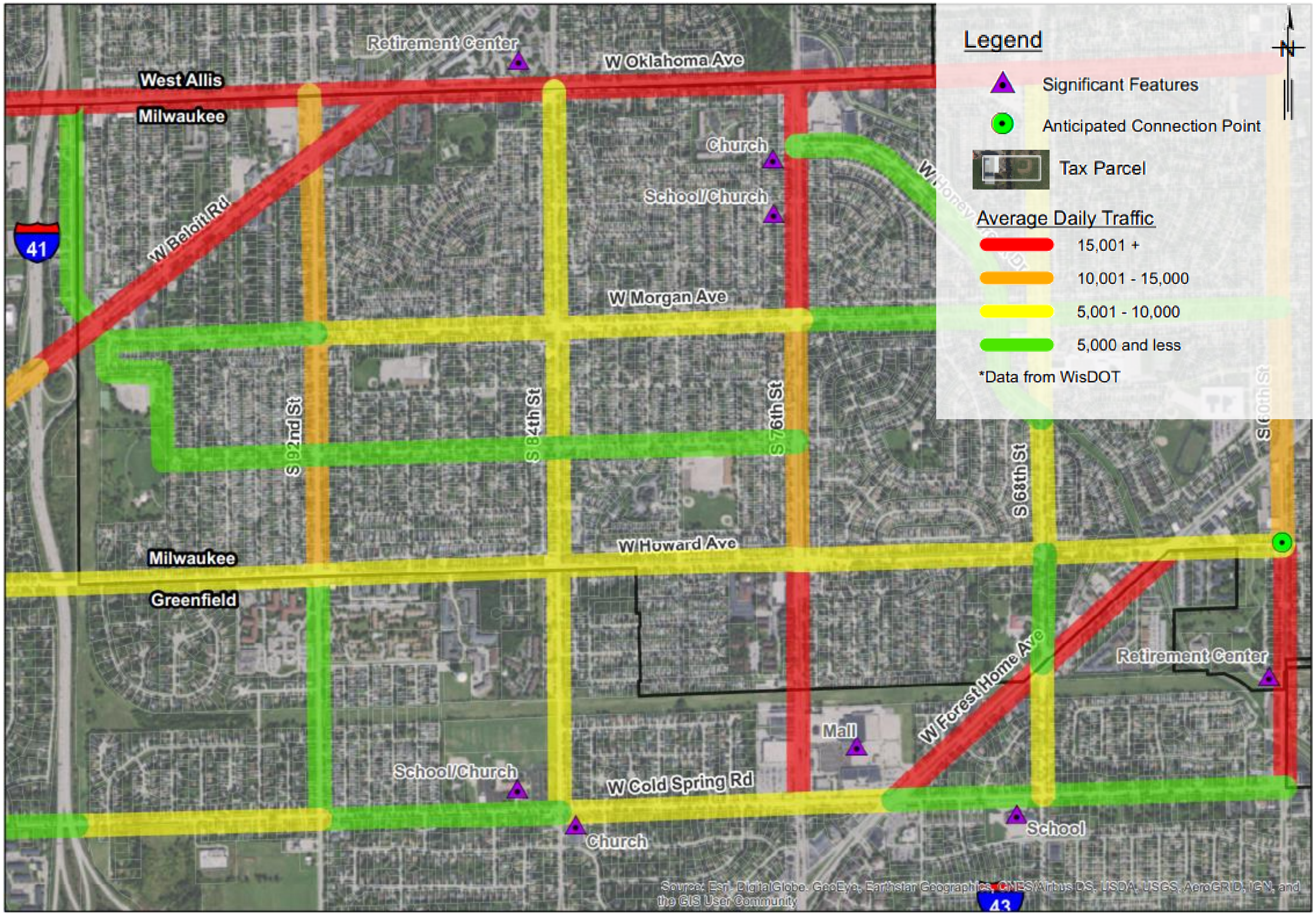
60th Street to Interstate 41: Sub-Alternatives

60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility GREELEY AND HANSEN

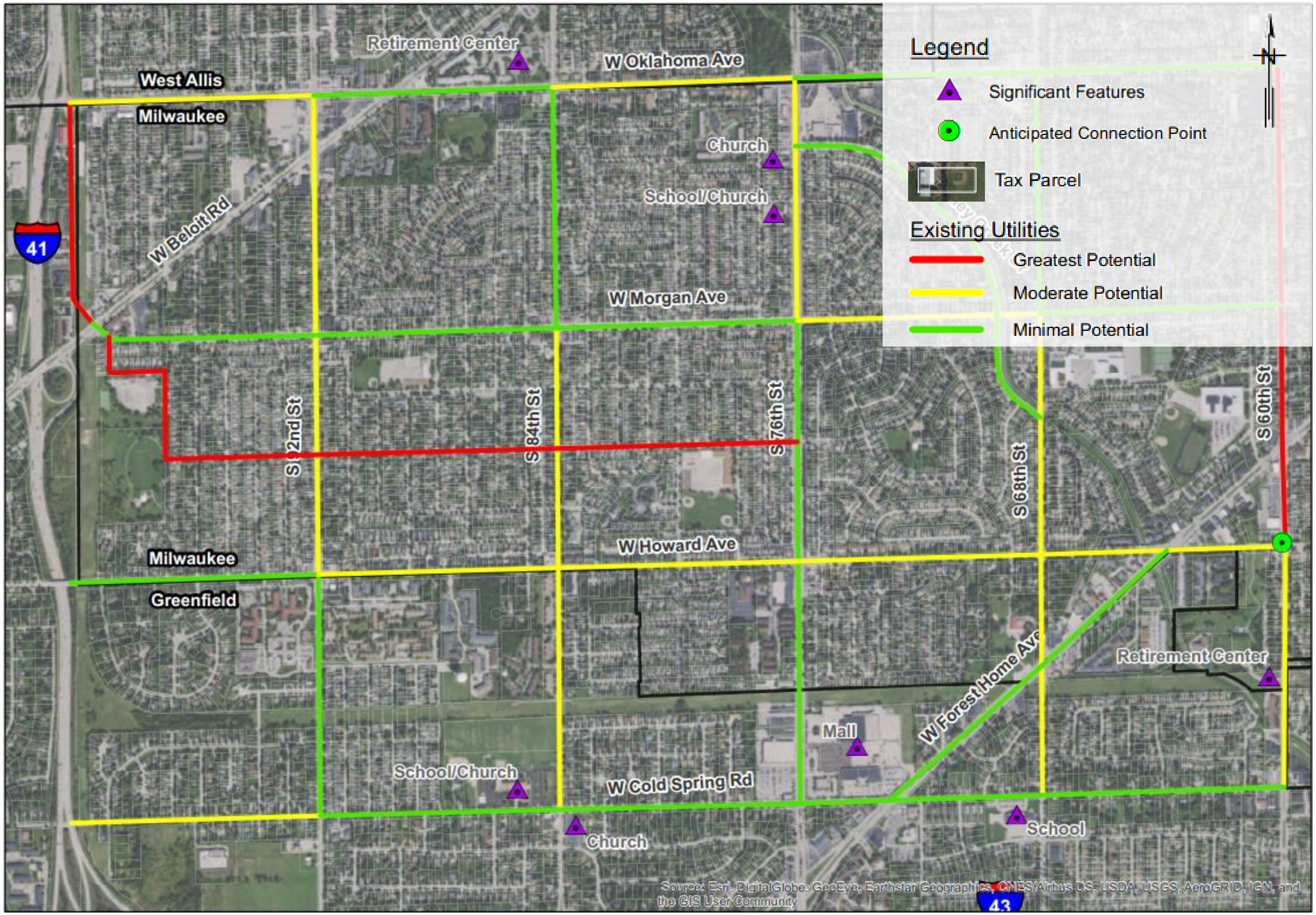
60th Street to Interstate 41: Sub-Alternatives



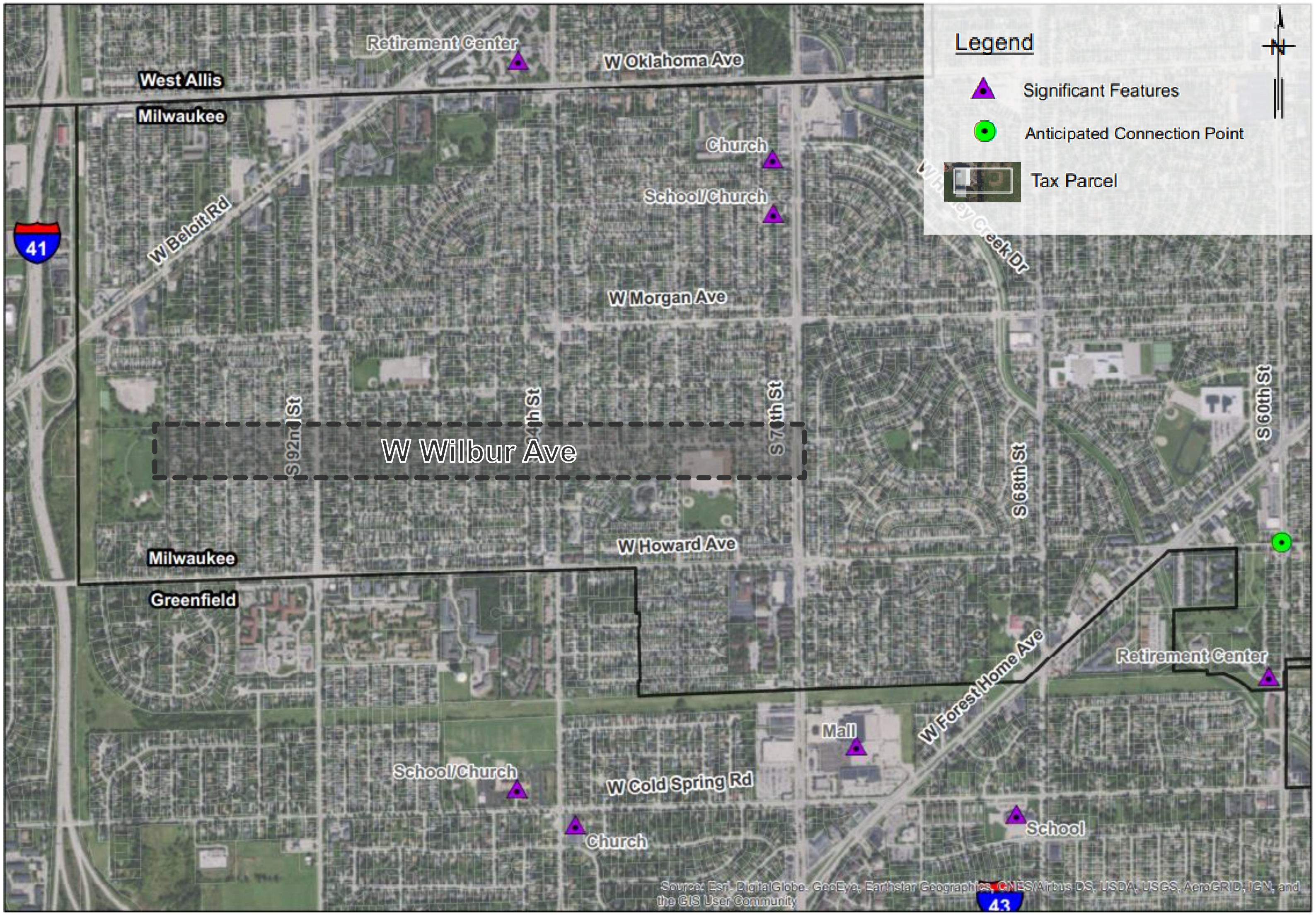
Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

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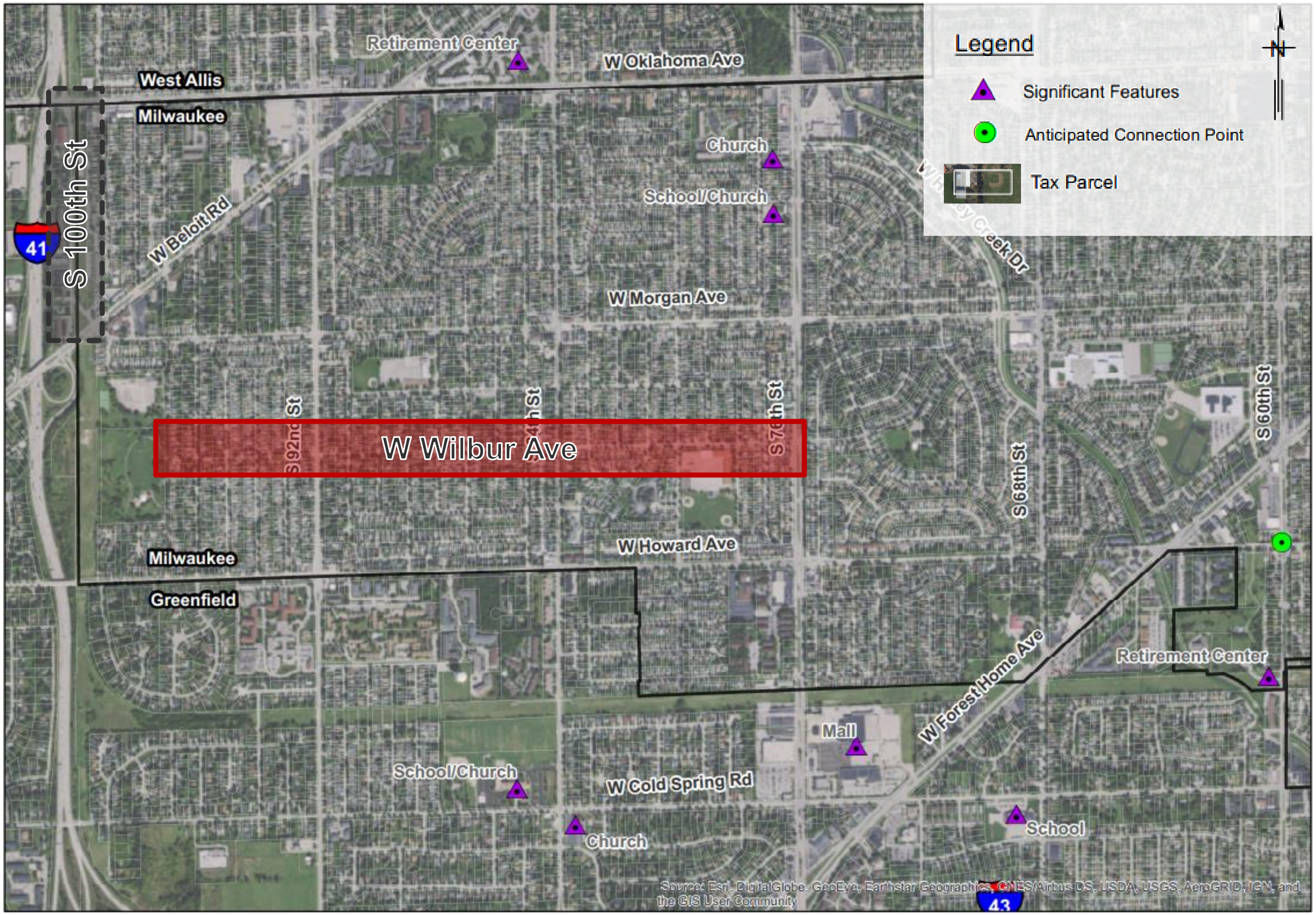
60th Street to Interstate 41: Sub-Alternatives

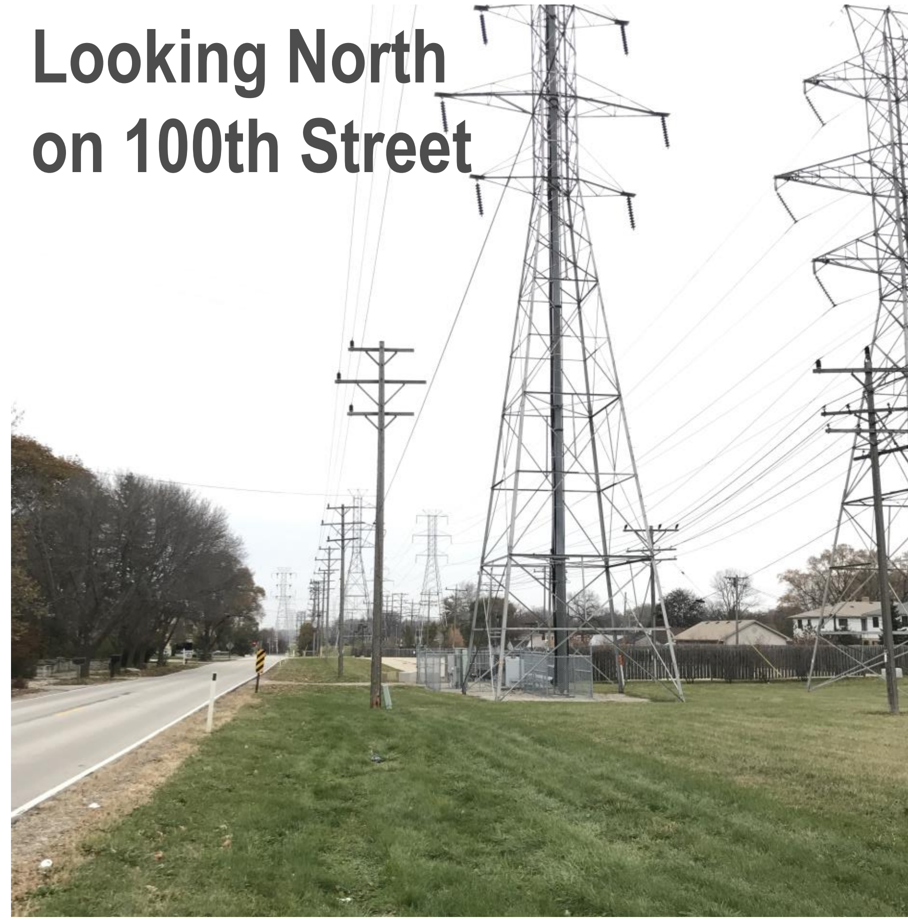
Waukesha Water Utility

GREELEY AND HANSEN

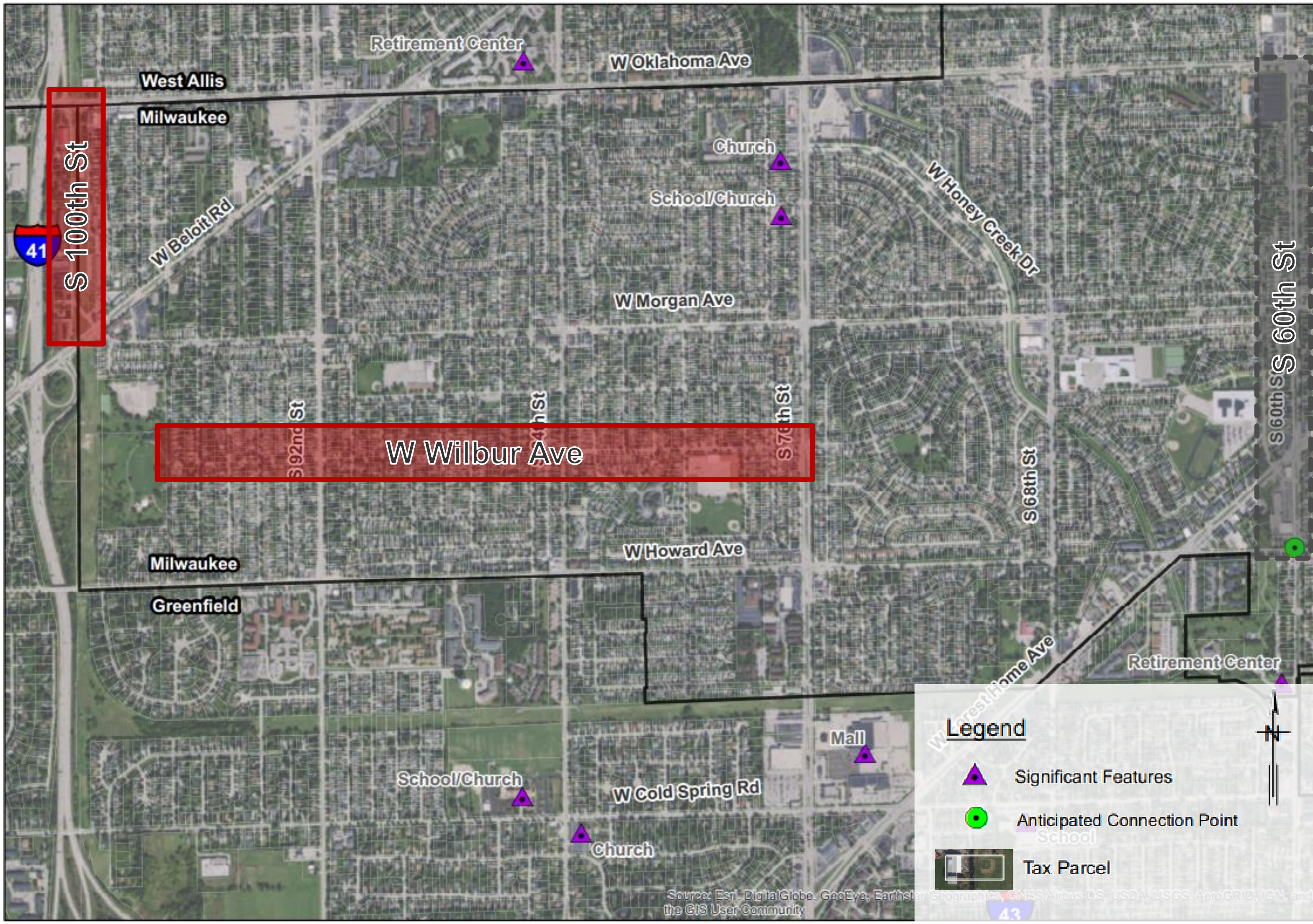
60th Street to Interstate 41: Sub-Alternatives



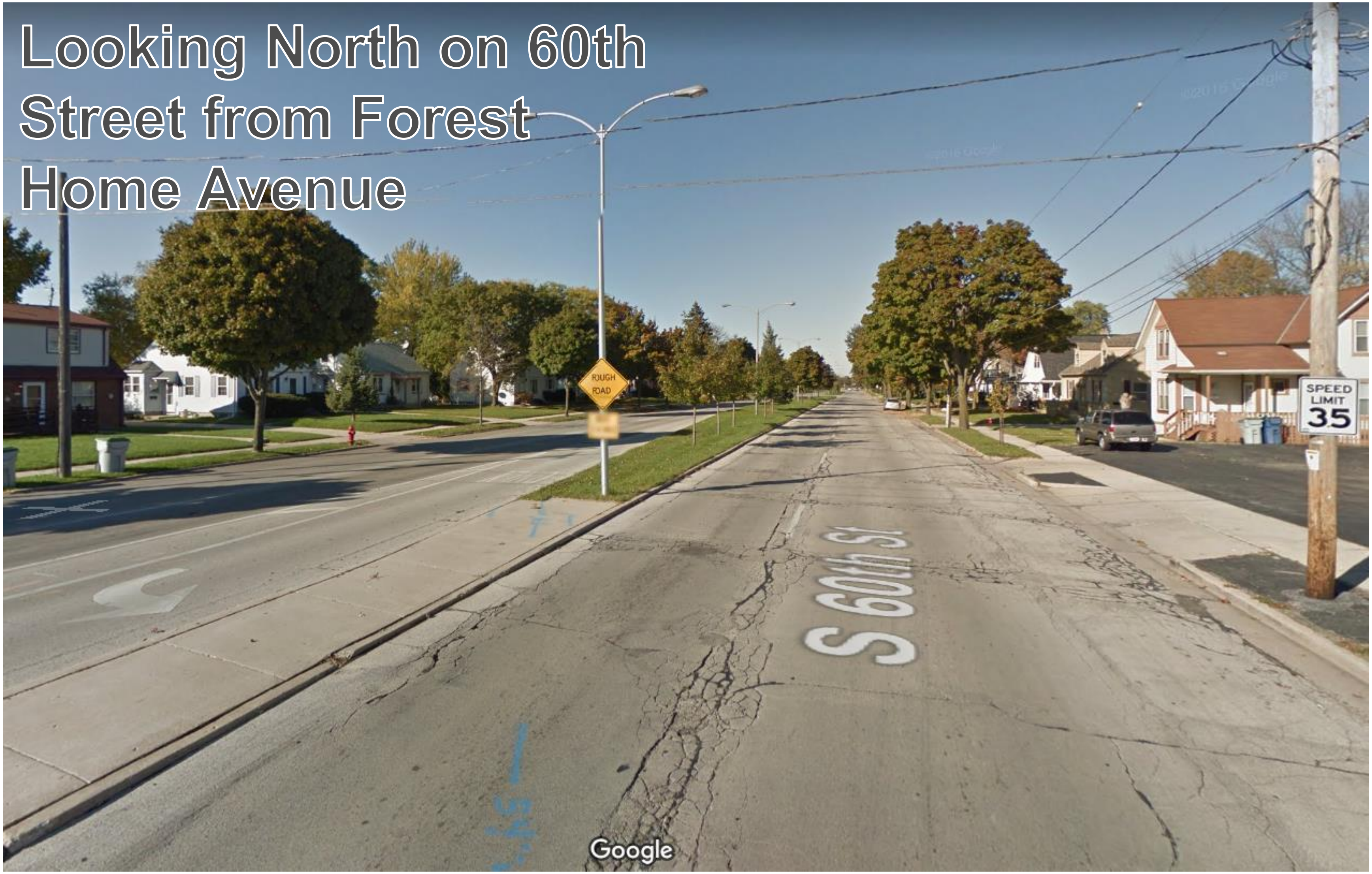
60th Street to Interstate 41: Sub-Alternatives



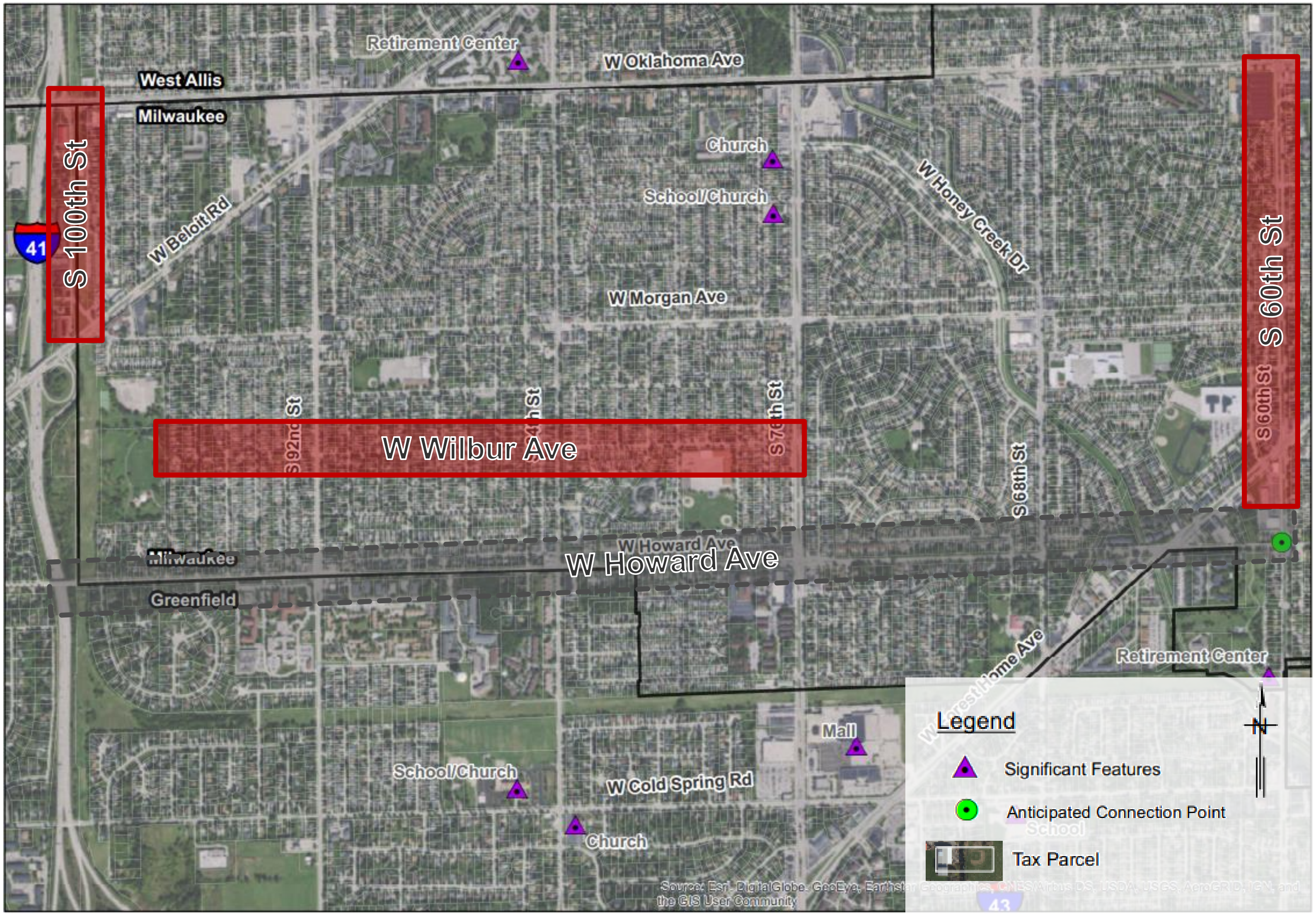
60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternatives



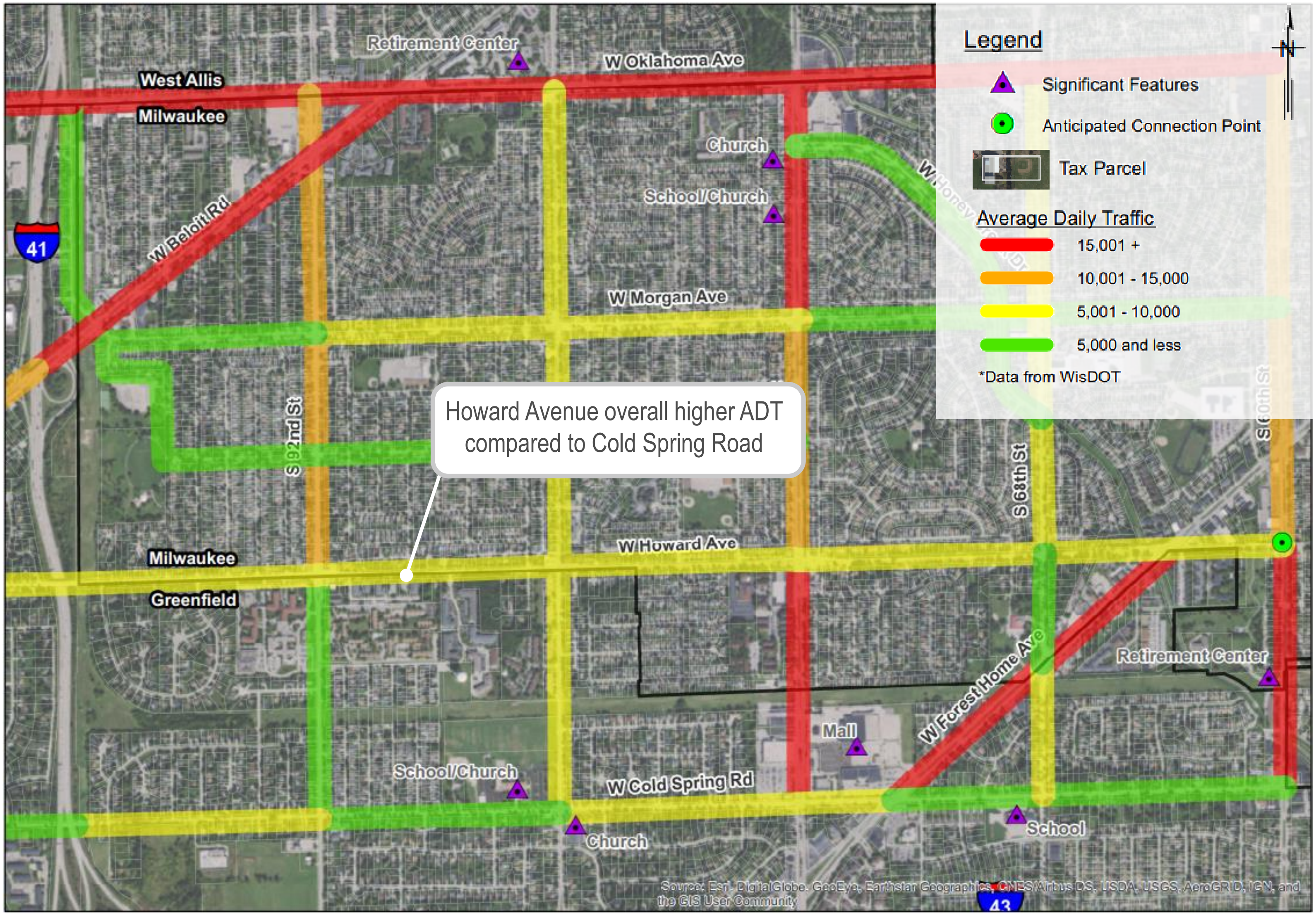
60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

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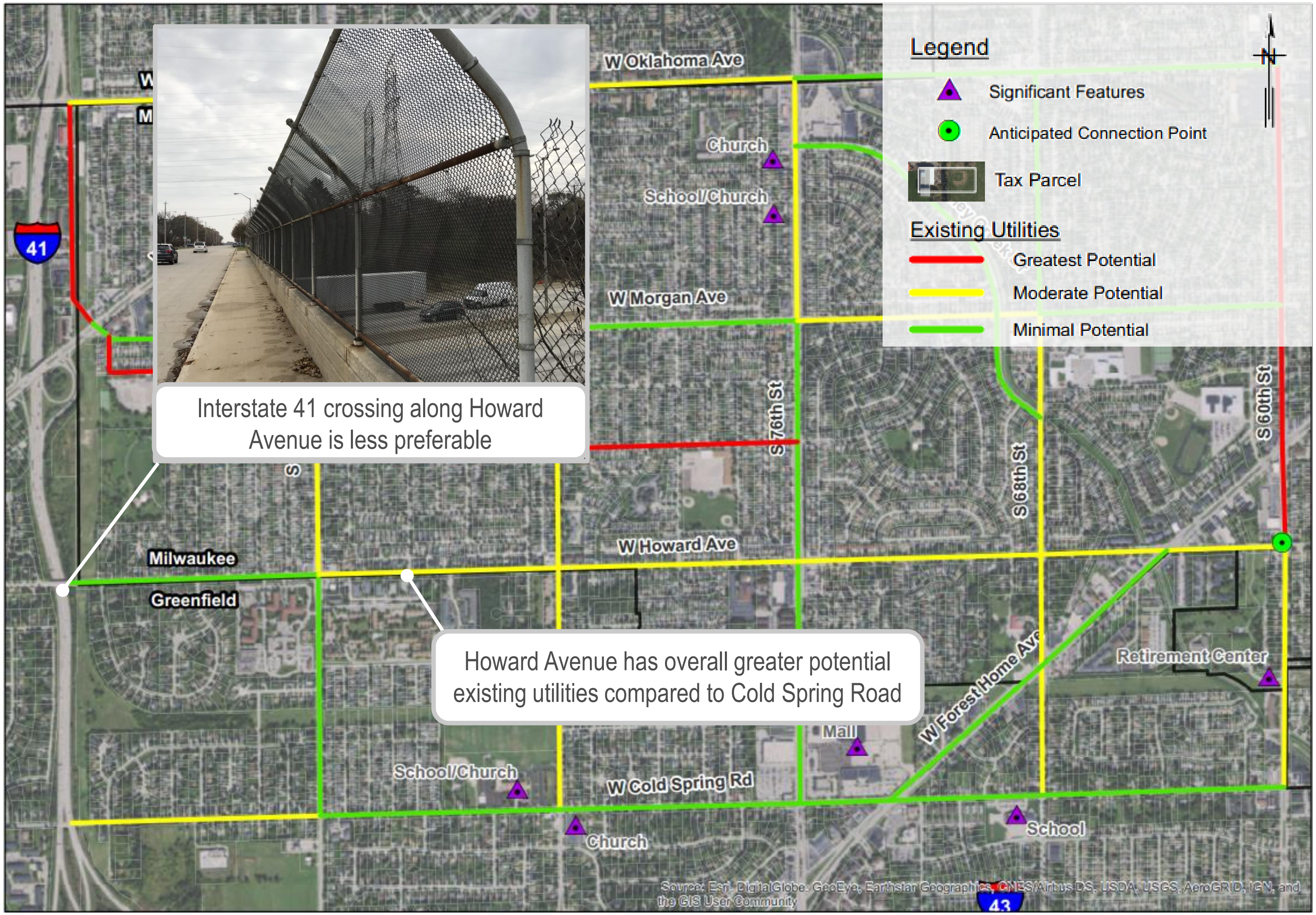
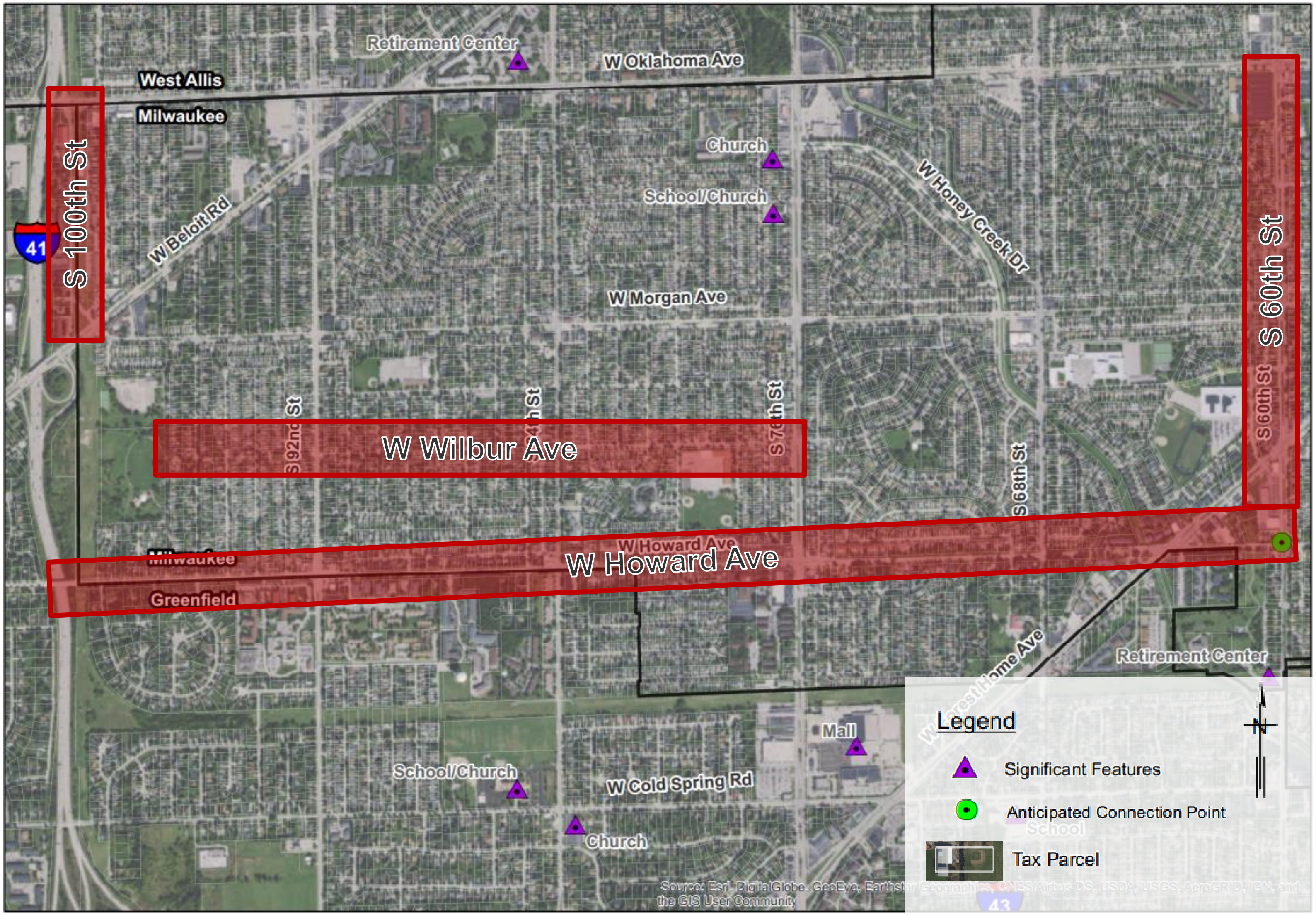
60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternatives

Route Nomenclature:

M1-1.1

60th Street to Interstate 41: Sub-Alternatives

Milwaukee Route Study

M1-1.1

60th Street to Interstate 41: Sub-Alternatives

Milwaukee Route Study

M1-1.1

Route Alternative (3 Total)

Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives

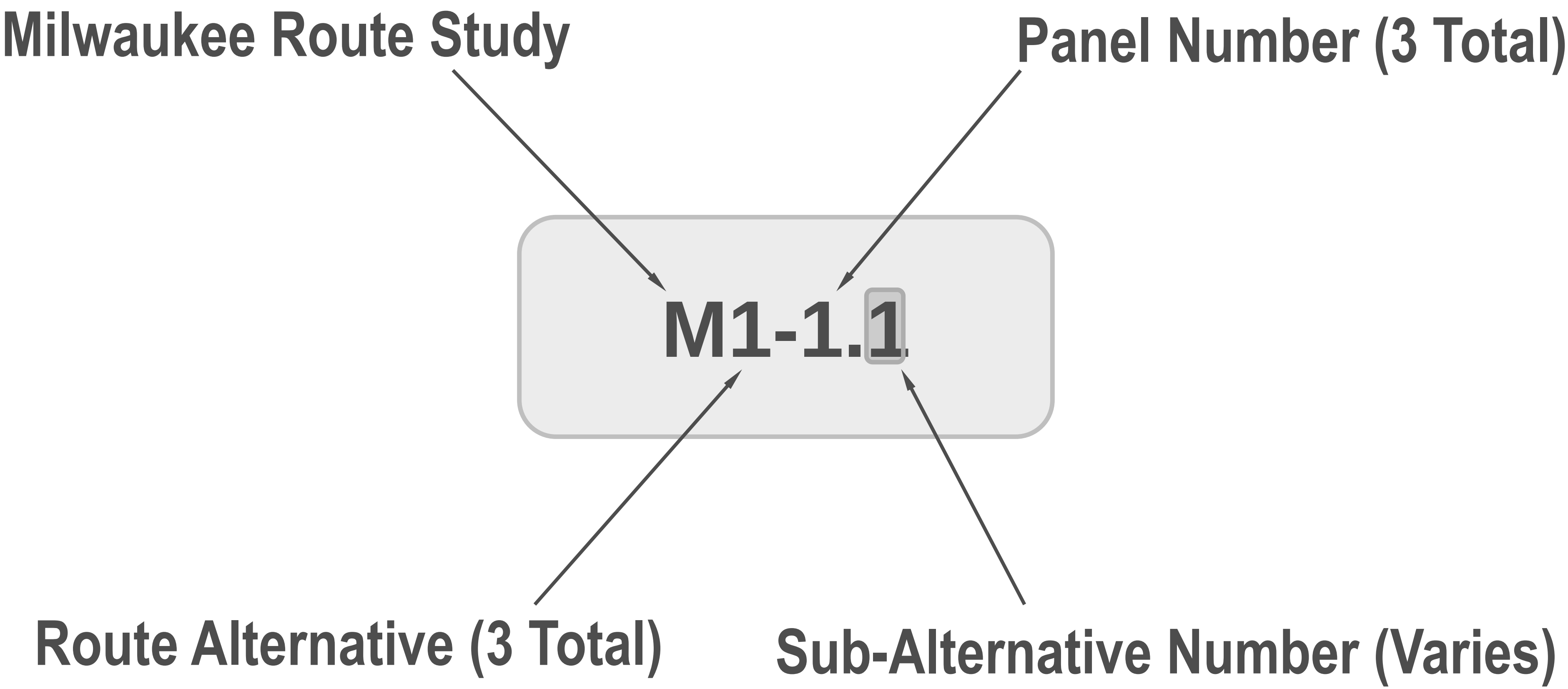
Milwaukee Route Study

Panel Number (3 Total)

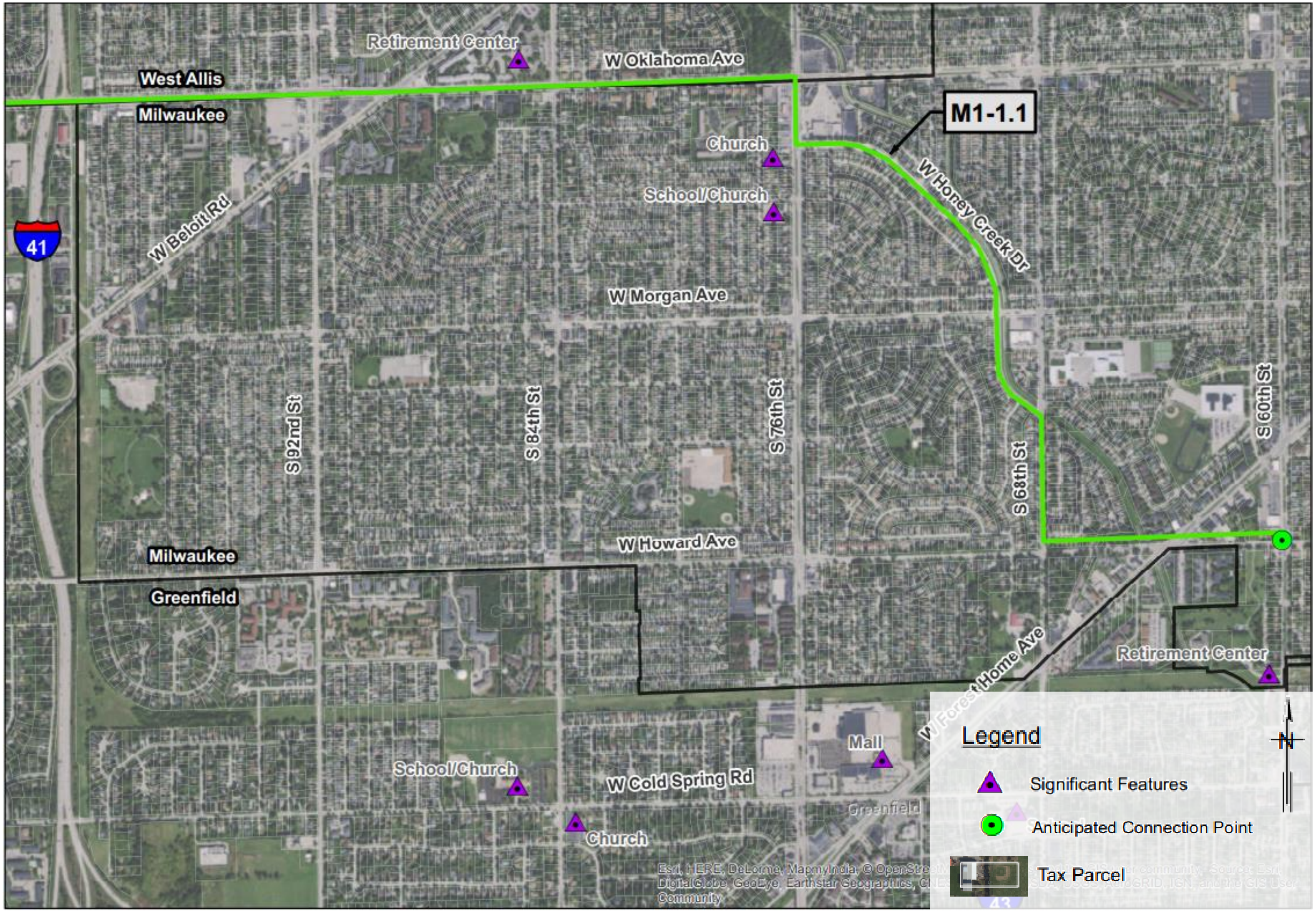
M1-1.1

Route Alternative (3 Total)

60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives

Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives

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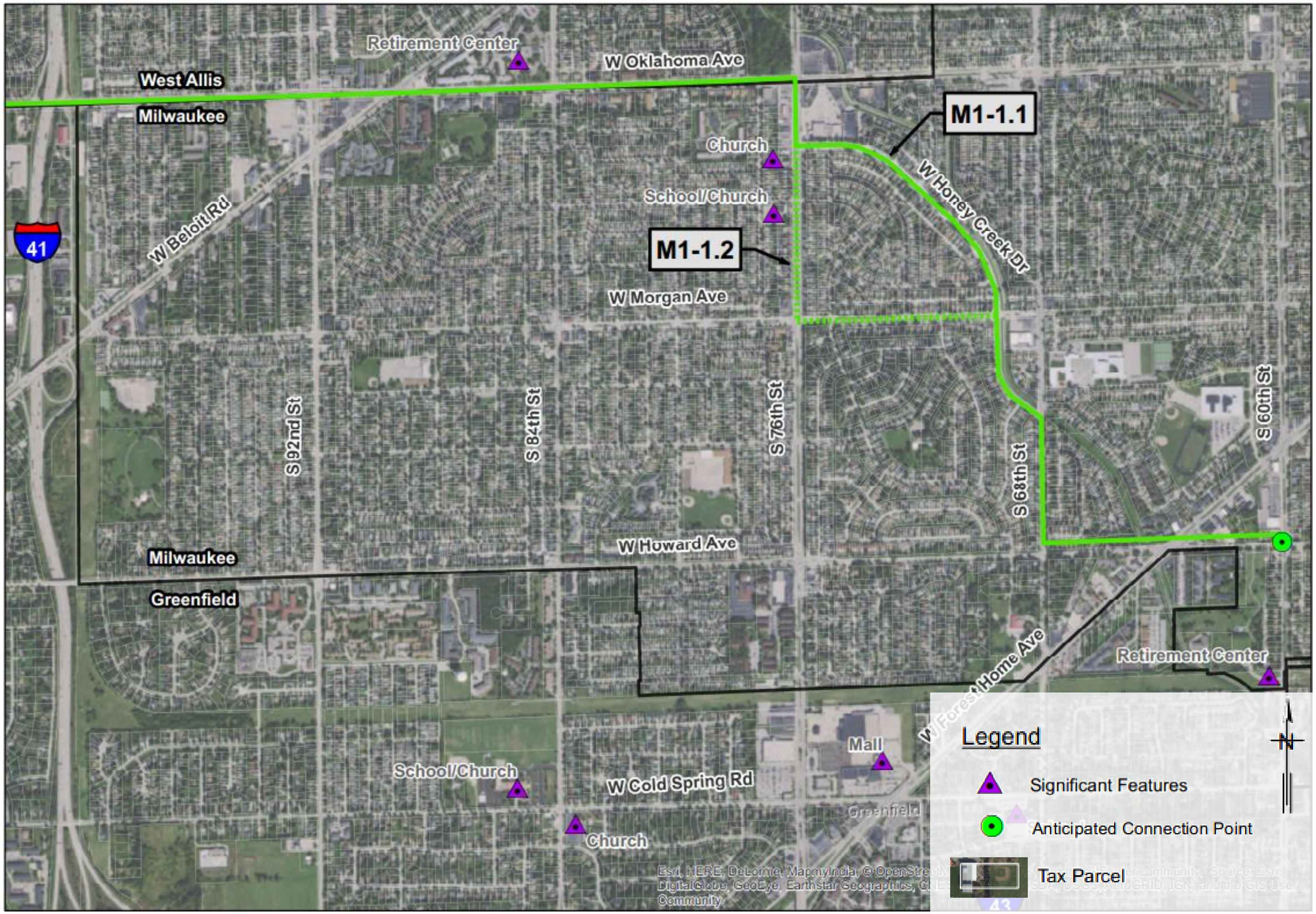
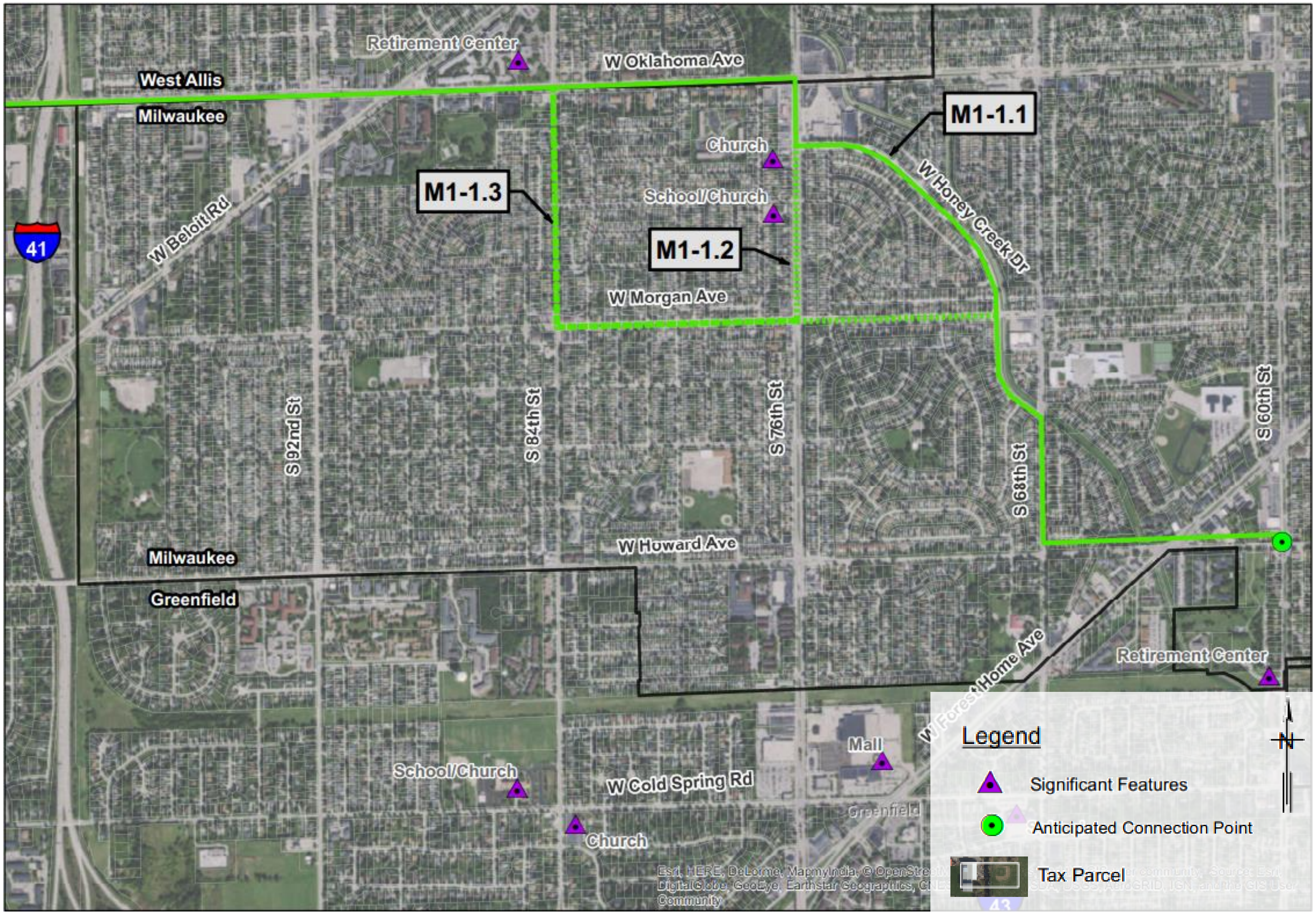


Waukesha Water Utility GREELEY AND HANSEN

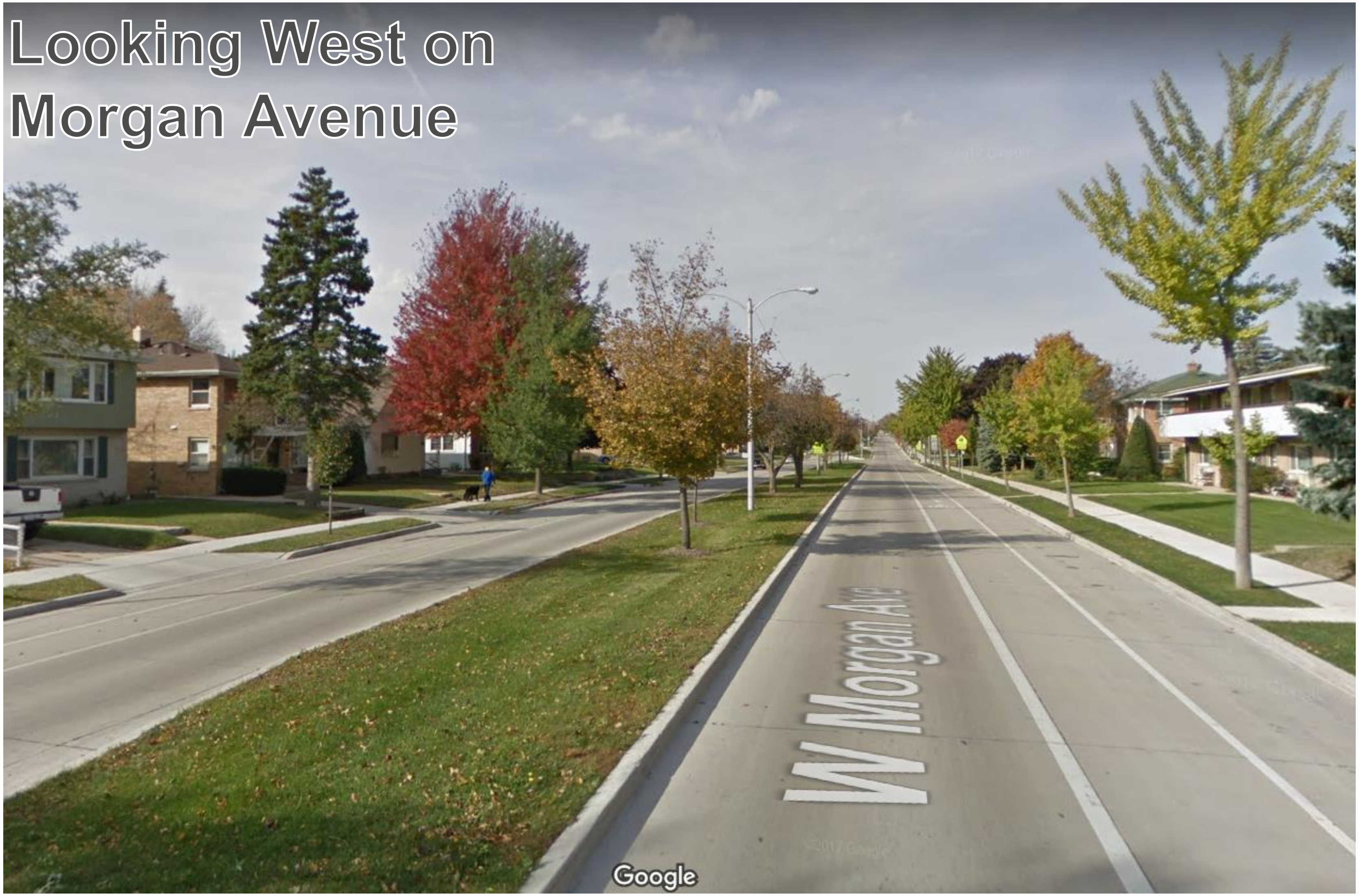
60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternatives



Waukesha Water Utility

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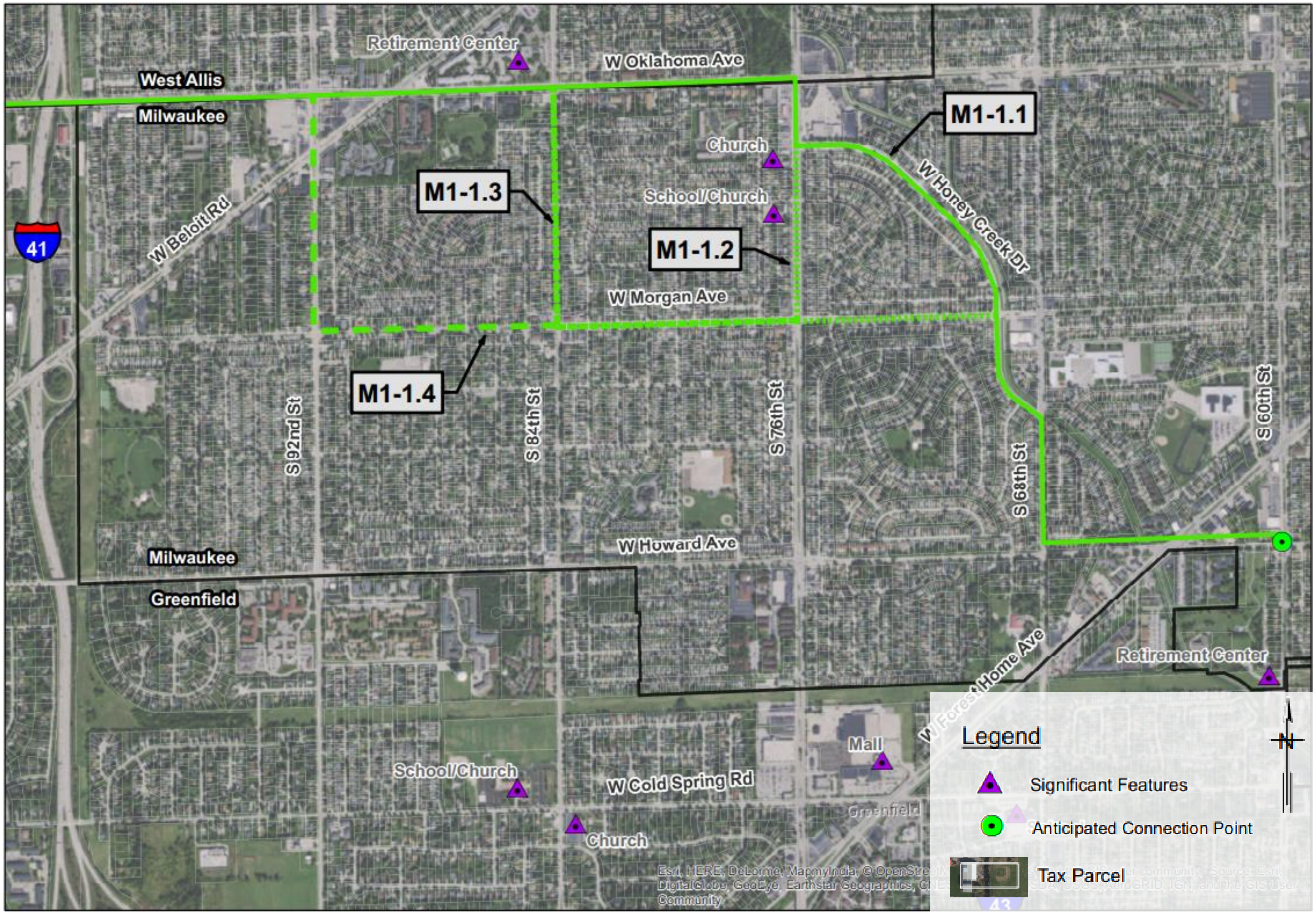
60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41				
	Route Sub-Alternative M1-1			
Evaluation Item	M1-1.1	M1-1.2	M1-1.3	M1-1.4
Sub-Alternative Length	17,700 ft	18,600 ft	18,600 ft	18,600 ft
Traffic	Low / High	Moderate / High	Moderate / High	Low / High
Right-of-Way Width	100-150 ft	100-150 ft	90-150 ft	90-150 ft
Approximate No. of Special Crossings	7	7	7	7
Approximate Special Crossing Length	1,600 ft	1,600 ft	1,600 ft	1,600 ft
No. of Easements	0	0	0	0
Easement Length	N/A	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Good	Good	Fair	Fair
Existing Utilities	Minimal	Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Passes two churches and one school	N/A	N/A

Less preferable due higher traffic, potential existing utilities, and adjacent to one school and two churches on 76th Street

60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41				
Evaluation Item	Route Sub-Alternative M1-1			
	M1-1.1	M1-1.2	M1-1.3	M1-1.4
Sub-Alternative Length	17,700 ft	18,600 ft	18,600 ft	18,600 ft
Traffic	Low / High	Moderate / High	Moderate / High	Low / High
Right-of-Way Width	100-150 ft	100-150 ft	90-150 ft	90-150 ft
Approximate No. of Special Crossings	7	7	7	7
Approximate Special Crossing Length	1,600 ft	1,600 ft	1,600 ft	1,600 ft
No. of Easements	0	0	0	0
Easement Length	N/A	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Good	Good	Fair	Fair
Existing Utilities	Minimal	Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Passes two churches and one school	N/A	N/A

Less preferable due to overall length

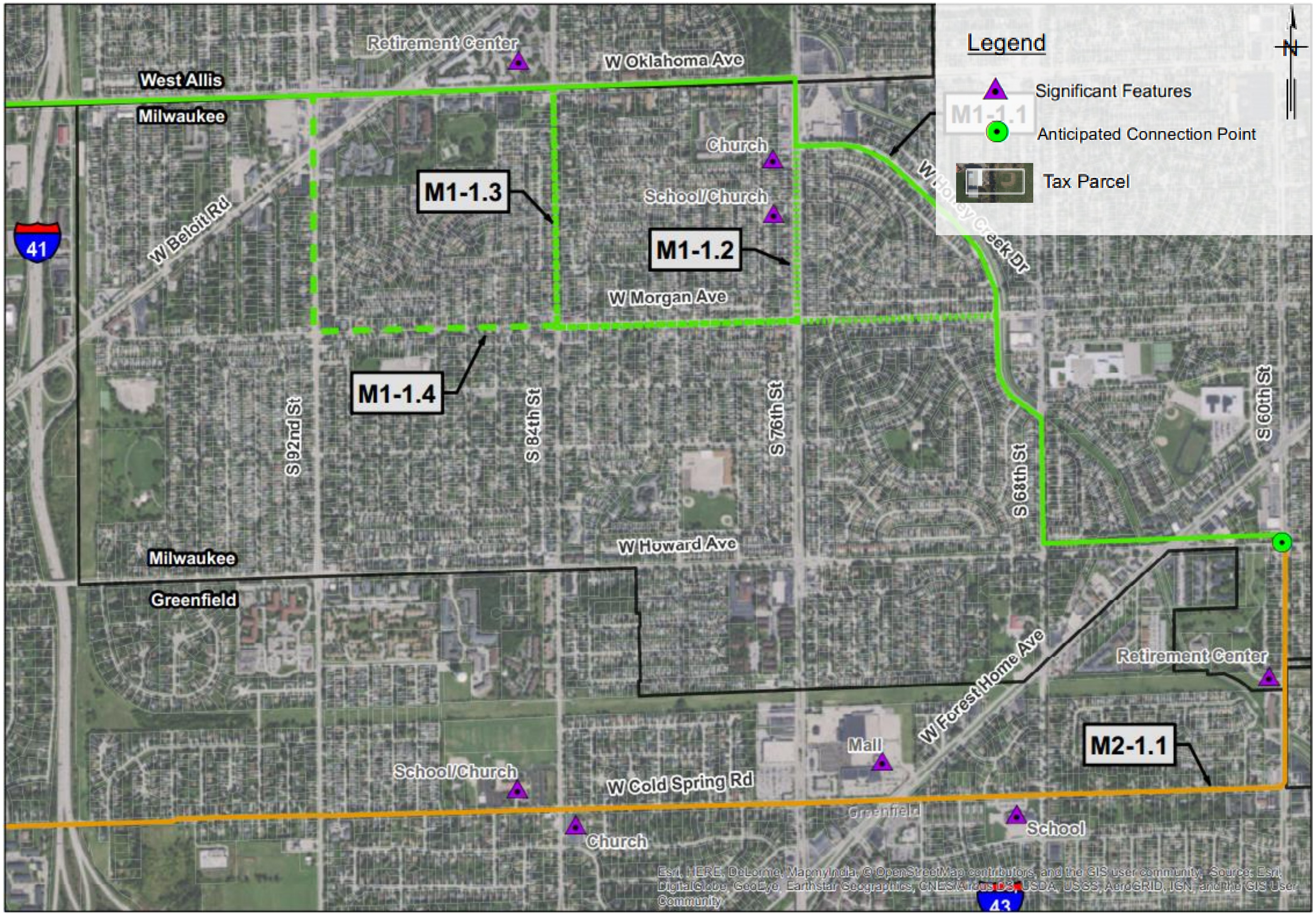
Waukesha Water Utility
GREELEY AND HANSEN

60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41				
	Route Sub-Alternative M1-1			
Evaluation Item	M1-1.1	M1-1.2	M1-1.3	M1-1.4
Sub-Alternative Length	17,700 ft	18,600 ft	18,600 ft	18,600 ft
Traffic	Low / High	Moderate / High	Moderate / High	Low / High
Right-of-Way Width	100-150 ft	100-150 ft	90-150 ft	90-150 ft
Approximate No. of Special Crossings	7	7	7	7
Approximate Special Crossing Length	1,600 ft	1,600 ft	1,600 ft	1,600 ft
No. of Easements	0	0	0	0
Easement Length	N/A	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Good	Good	Fair	Fair
Existing Utilities	Minimal	Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Passes two churches and one school	N/A	N/A

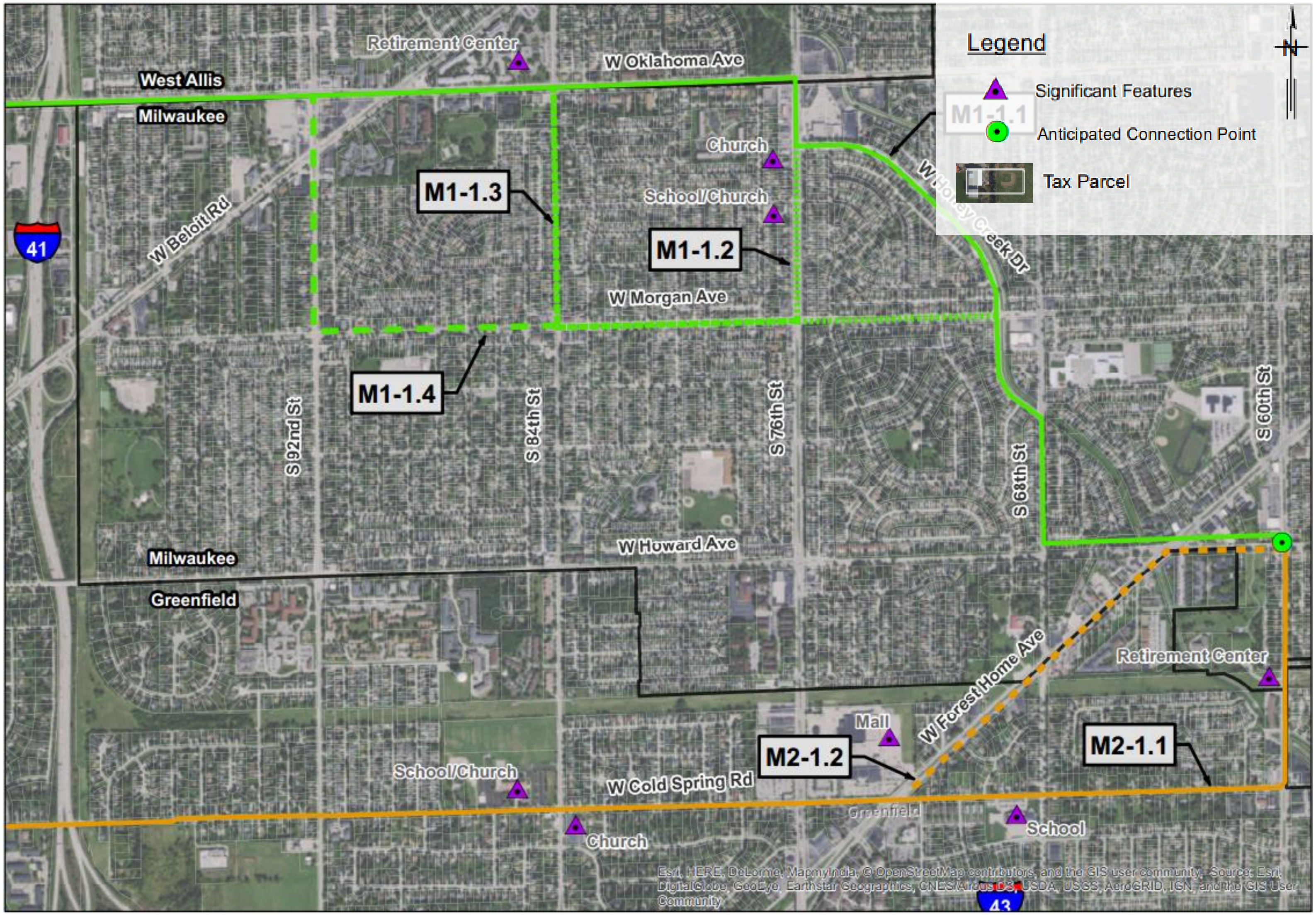
Sub-Alternative M1-1.1	
Advantages	**Disadvantages**
• Shortest length • Wide right-of-way on majority of corridor • Fewer anticipated utilities • Honey Creek Drive is a better alternative	• High traffic on Oklahoma Avenue

60th Street to Interstate 41: Sub-Alternatives

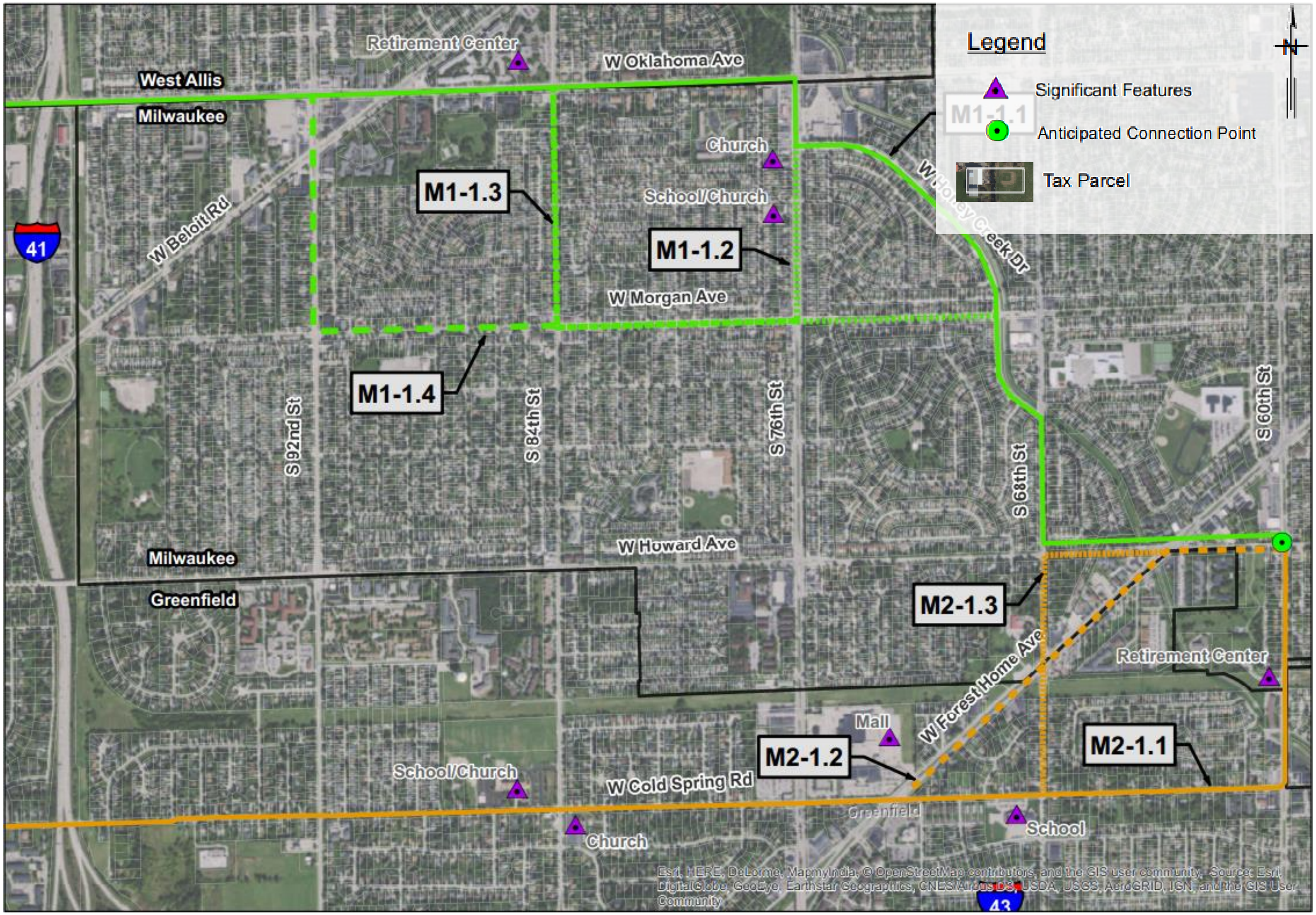


60th Street to Interstate 41: Sub-Alternatives

60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternatives



60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41			
	Route Sub-Alternative M3-1		
Evaluation Item	M2-1.1	M2-1.2	M2-1.3
Sub-Alternative Length	16,100 ft	14,500 ft	16,100 ft
Traffic	High / Low	High / Low	Moderate / Low
Right-of-Way Width	90-110 ft	90-120 ft	90-110 ft
Approximate No. of Special Crossings	5	5	6
Approximate Special Crossing Length	900 ft	900 ft	1,600 ft
No. of Easements	0	0	0
Easement Length	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low
Constructability	Fair	Good	Fair
Existing Utilities	Minimal / Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Crosses mall twice	N/A

Less preferable due to higher traffic and potential existing utilities on 60th Street

60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41			
	Route Sub-Alternative M3-1		
Evaluation Item	M2-1.1	M2-1.2	M2-1.3
Sub-Alternative Length	16,100 ft	14,500 ft	16,100 ft
Traffic	High / Low	High / Low	Moderate / Low
Right-of-Way Width	90-110 ft	90-120 ft	90-110 ft
Approximate No. of Special Crossings	5	5	6
Approximate Special Crossing Length	900 ft	900 ft	1,600 ft
No. of Easements	0	0	0
Easement Length	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low
Constructability	Fair	Good	Fair
Existing Utilities	Minimal / Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Crosses mall twice	N/A

Less preferable due to total length and special crossing lengths

60th Street to Interstate 41: Sub-Alternative Comparison

Sub-Alternatives Evaluation: 60th Street to Interstate 41			
	Route Sub-Alternative M3-1		
Evaluation Item	M2-1.1	M2-1.2	M2-1.3
Sub-Alternative Length	16,100 ft	14,500 ft	16,100 ft
Traffic	High / Low	High / Low	Moderate / Low
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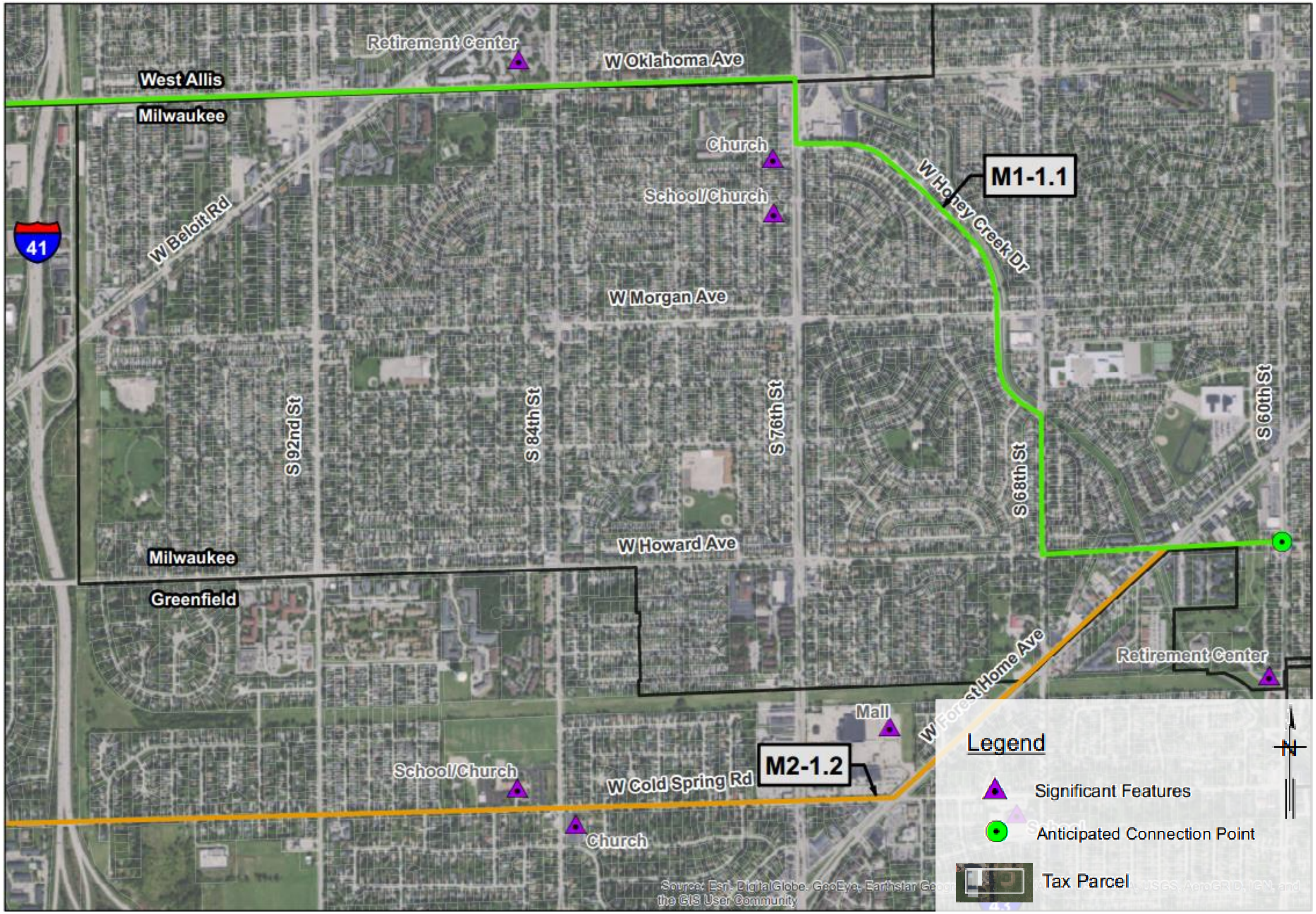
Approximate No. of Special Crossings	5	5	6
Approximate Special Crossing Length	900 ft	900 ft	1,600 ft
No. of Easements	0	0	0
Easement Length	N/A	N/A	N/A
Potential Wetland Impacts	Low	Low	Low
Constructability	Fair	Good	Fair
Existing Utilities	Minimal / Moderate	Minimal	Minimal / Moderate
Additional Considerations	N/A	Crosses mall twice	N/A

Sub-Alternative M2-1.2	
Advantages	**Disadvantages**
• Shortest length • Fewer potential utilities • Shorter special crossing length	• Commercial corridor and higher traffic on Forest Home Avenue

Waukesha Water Utility

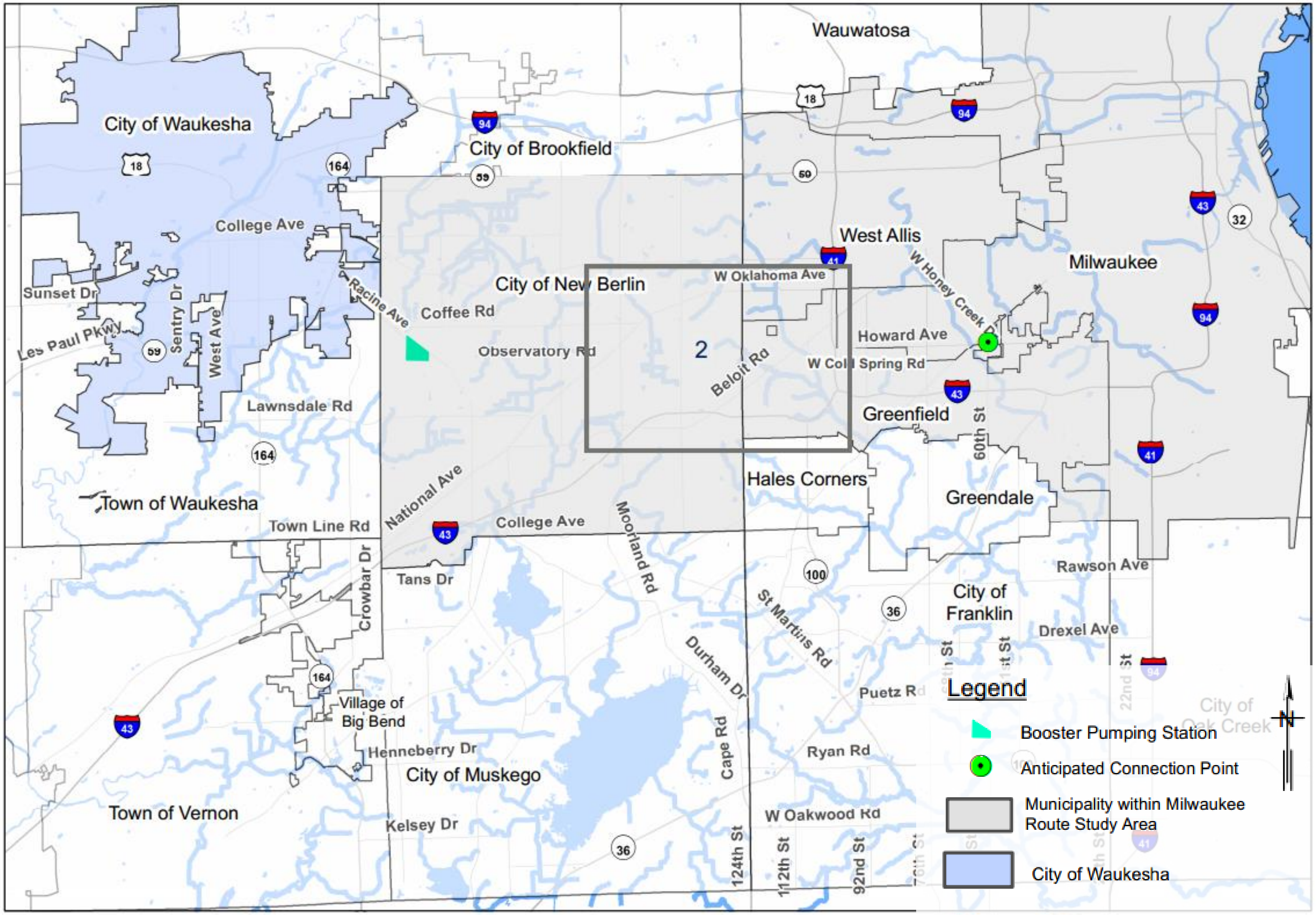
GREELEY AND HANSEN

60th Street to Interstate 41: Routes for Further Evaluation



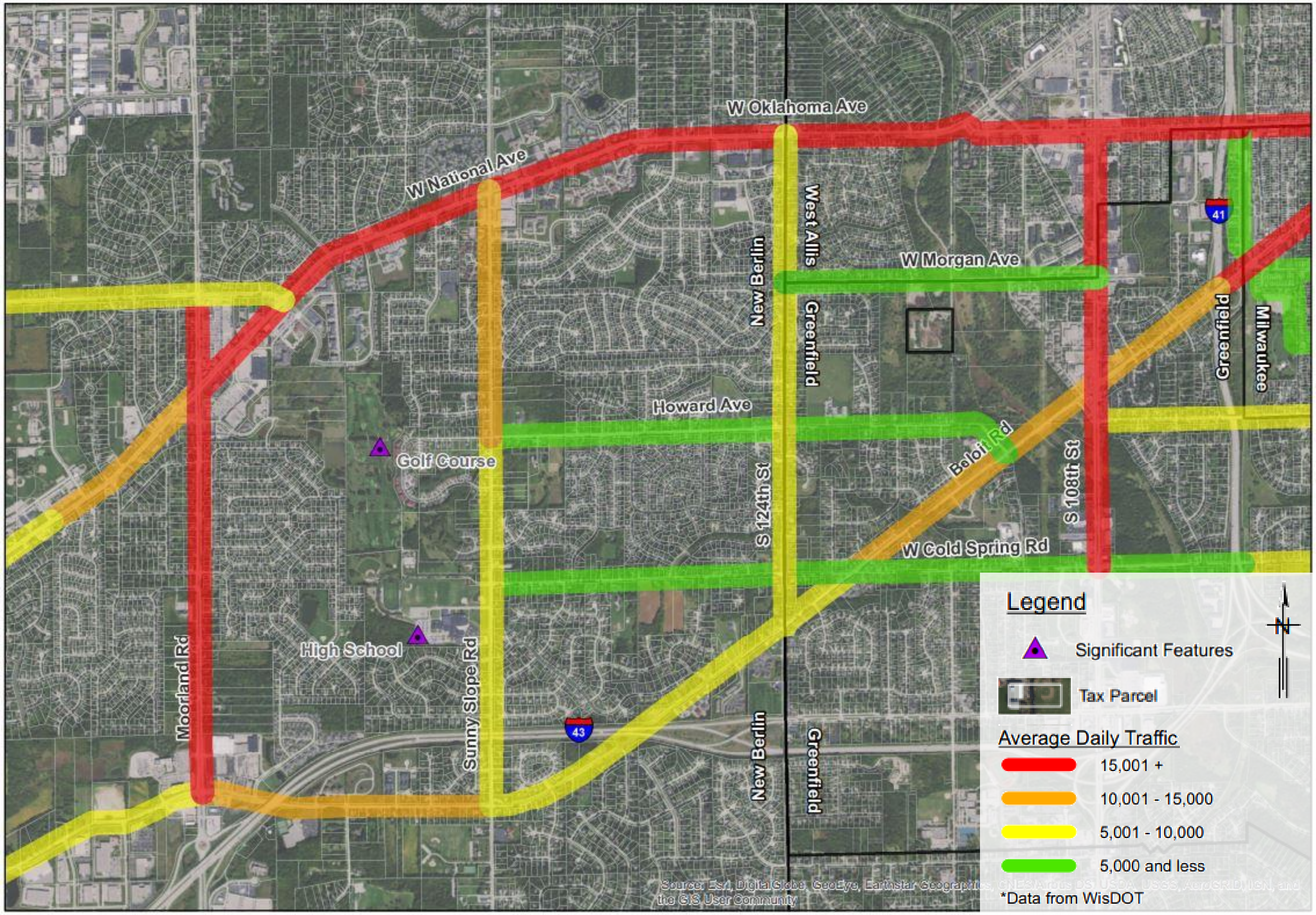
Interstate 41 to Moorland Road

Interstate 41 to Moorland Road: Route Study Area



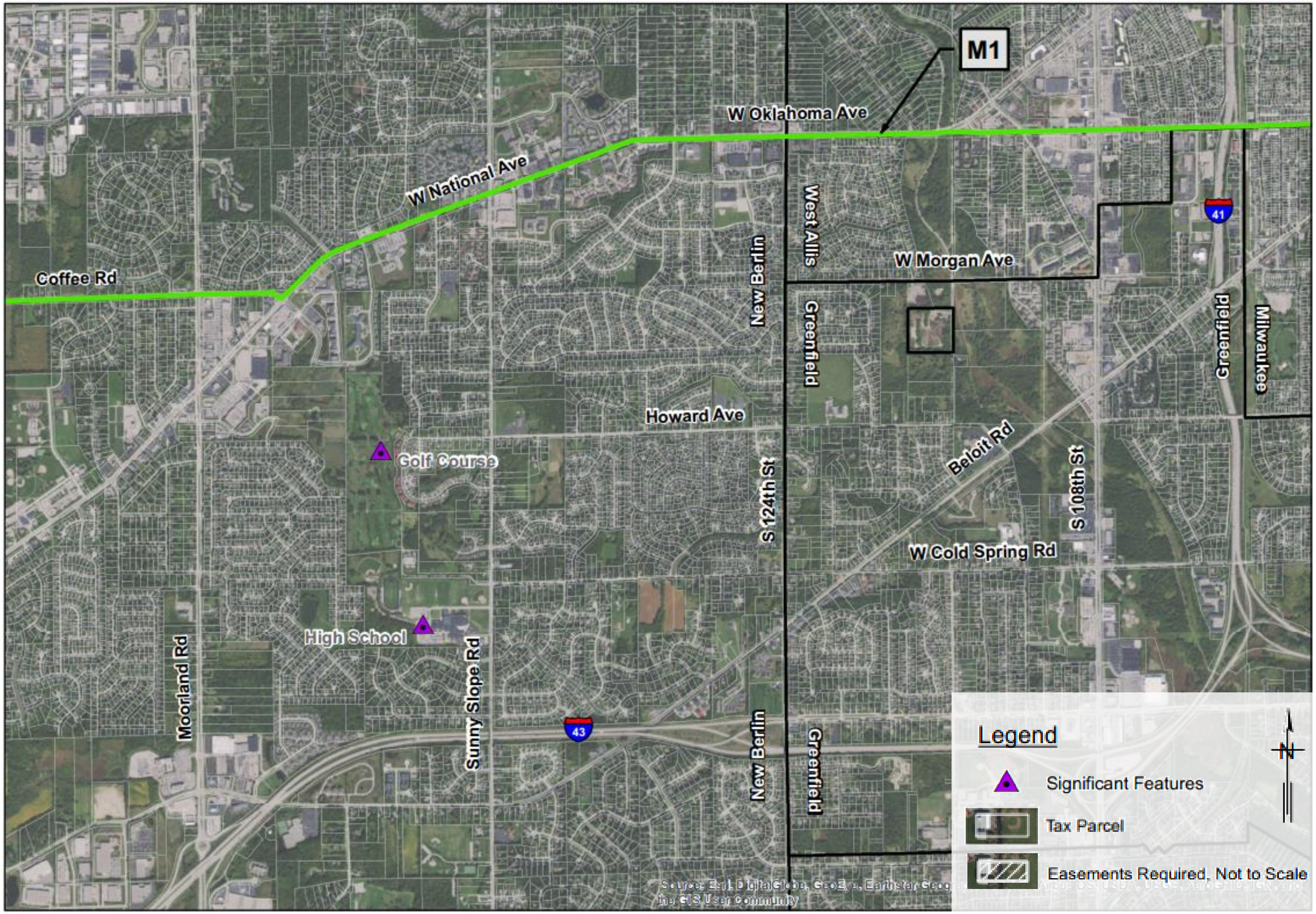
Waukesha Water Utility GREELEY AND HANSEN

Interstate 41 to Moorland Road: Sub-Alternatives

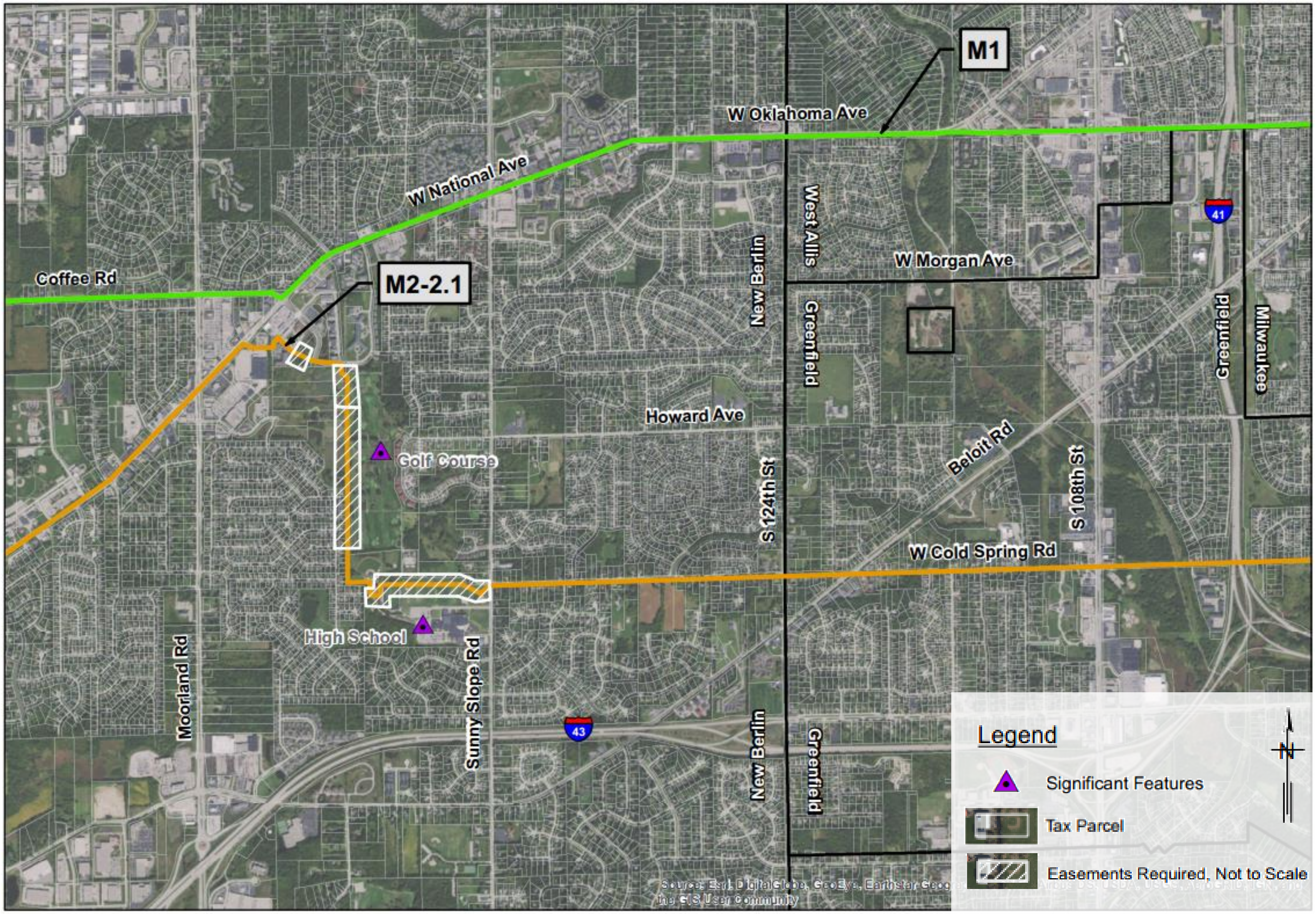


Waukesha Water Utility GREELEY AND HANSEN

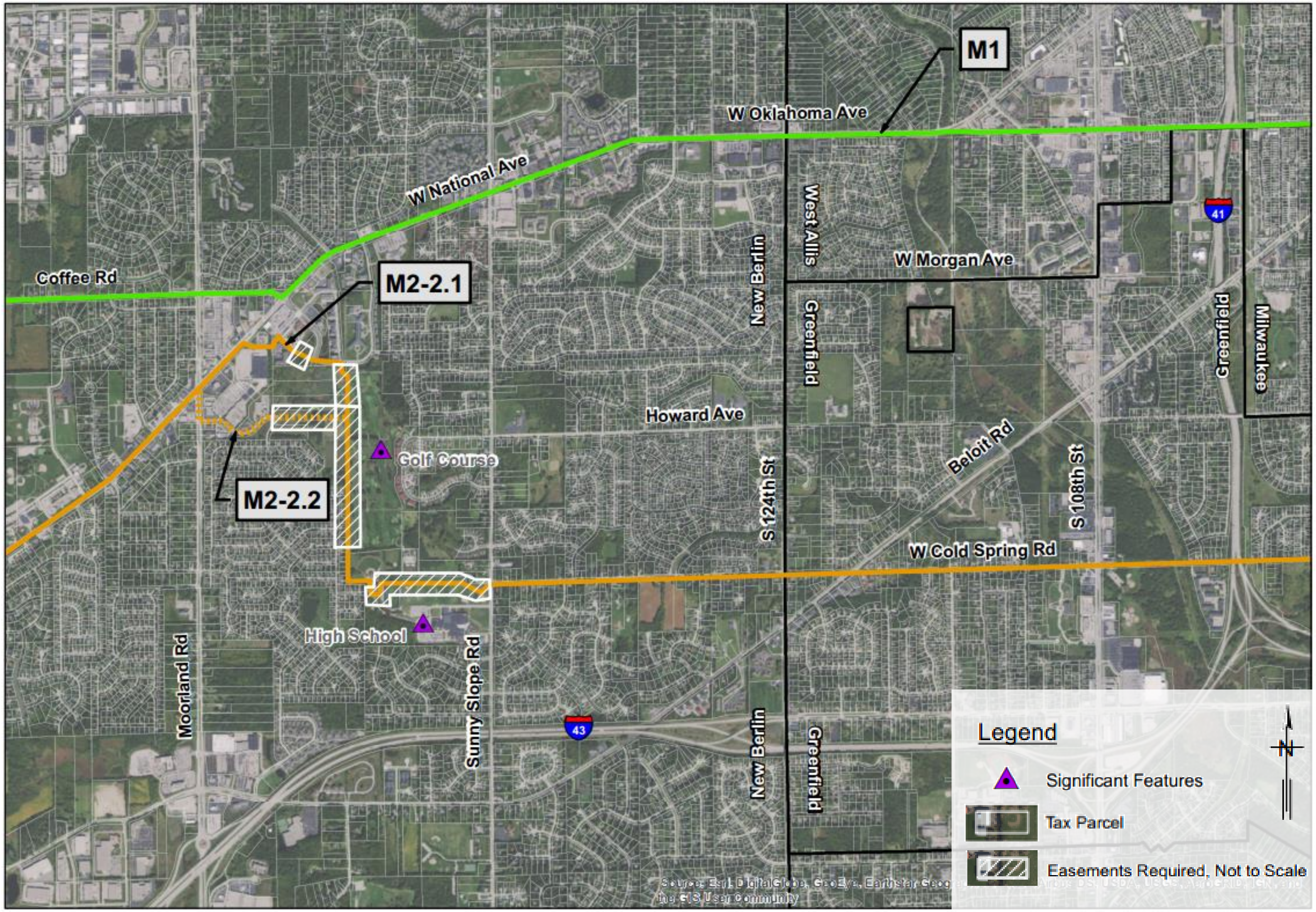
Interstate 41 to Moorland Road: Sub-Alternatives



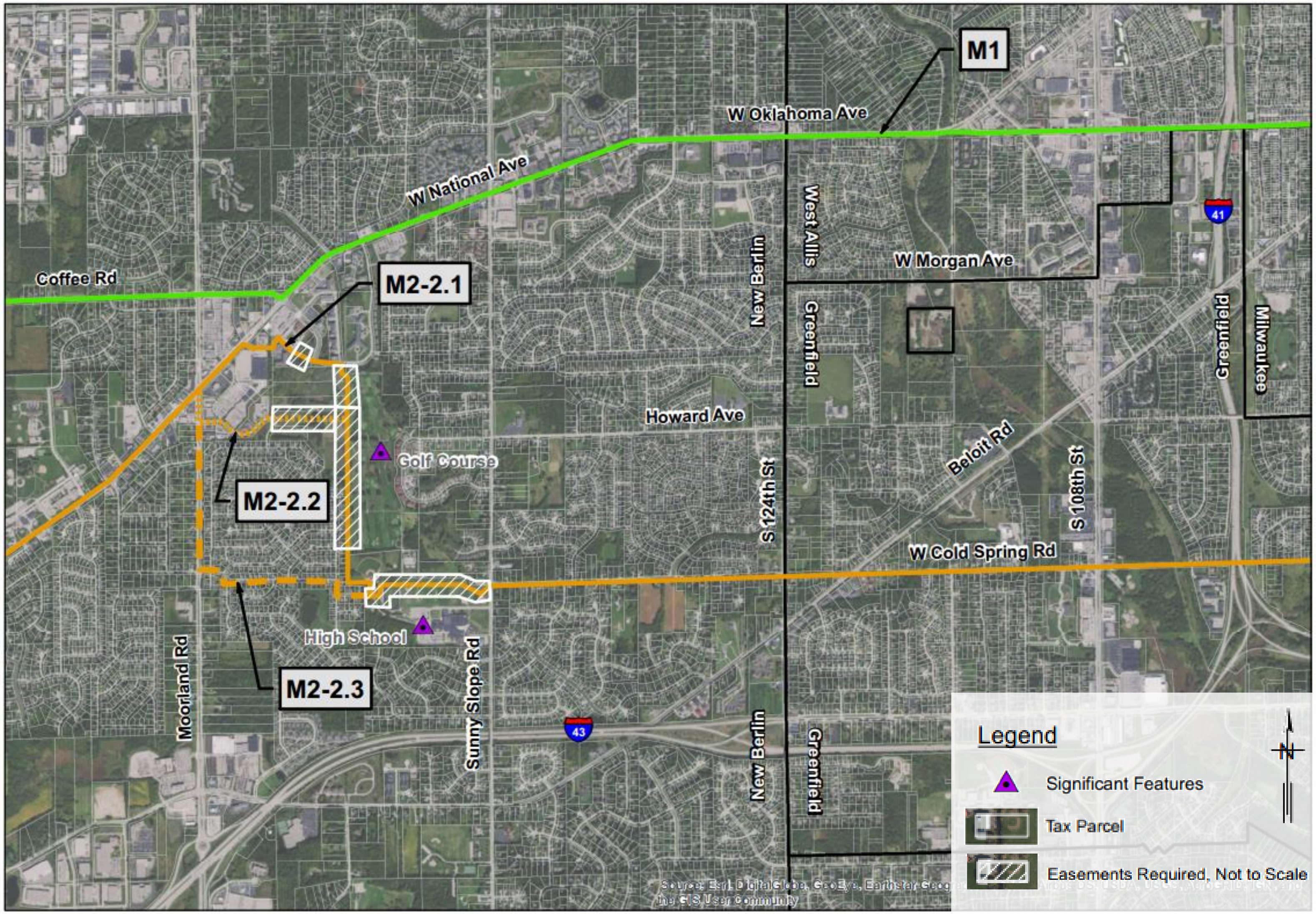
Interstate 41 to Moorland Road: Sub-Alternatives



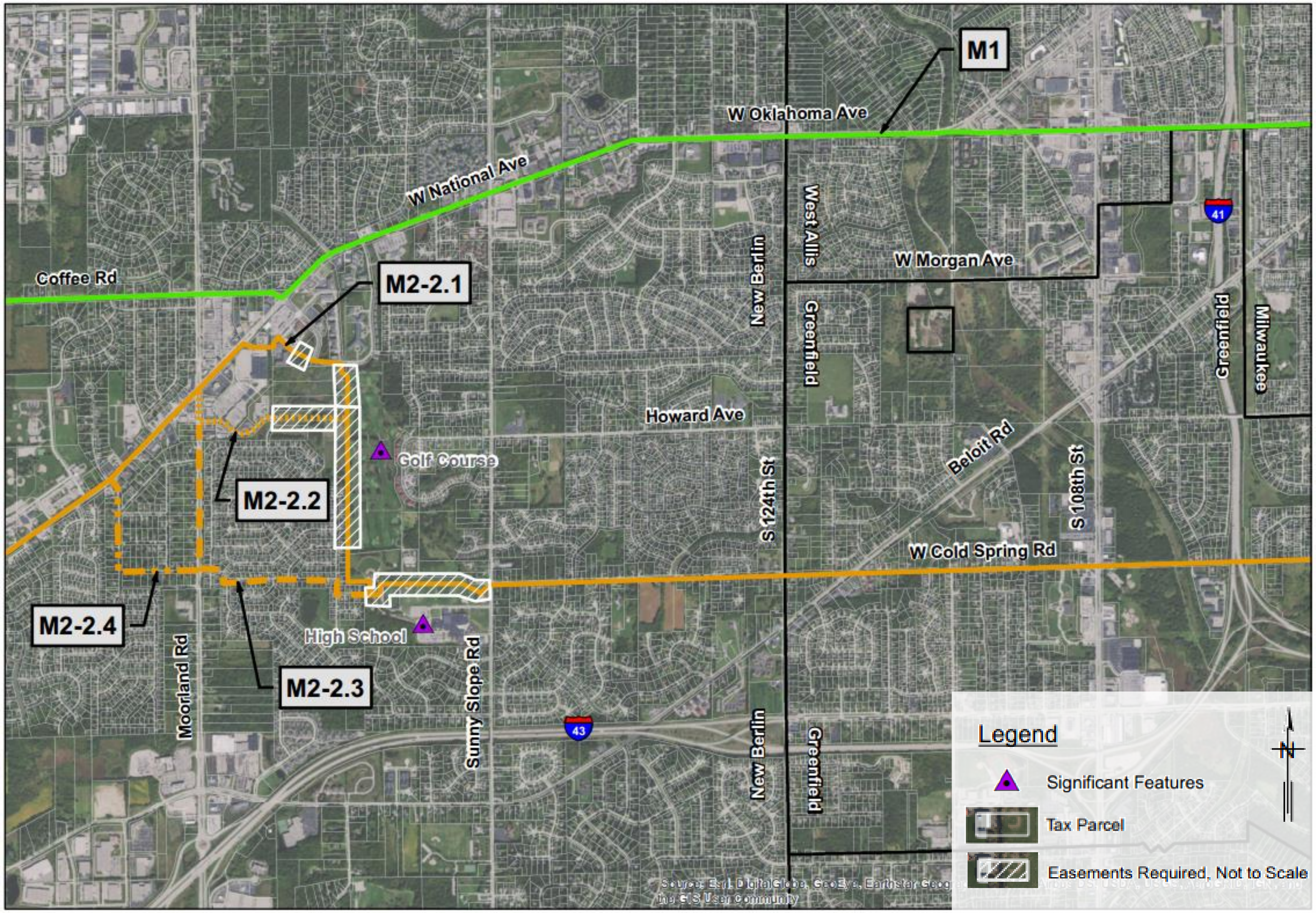
Interstate 41 to Moorland Road: Sub-Alternatives



Interstate 41 to Moorland Road: Sub-Alternatives



Interstate 41 to Moorland Road: Sub-Alternatives



Waukesha Water Utility GREELEY AND HANSEN

Interstate 41 to Moorland Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Interstate 41 to Moorland Road				
	Route M2-2 Sub-Alternatives			
Evaluation Item	M2-2.1	M2-2.2	M2-2.3	M2-2.4
Sub-Alternative Length	25,500 ft	24,700 ft	24,600 ft	22,400 ft
Traffic	Moderate	Low	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	60-115 ft	55-115 ft
Approximate No. of Special Crossings	7	6	6	5
Approximate Special Crossing Length	2,450 ft	2,850 ft	1,750 ft	1,400 ft
No. of Easements	4	3	1	1
Easement Length	3,700 ft	4,300 ft	2,700 ft	2,700 ft
Potential Wetland Impacts	Moderate	Moderate	Low	Low
Constructability	Fair	Fair	Fair	Fair
Existing Utilities	Moderate	Moderate	Moderate	Moderate
Additional Considerations	High School, Golf Course	High School, Golf Course	High School, Residential Neighborhood	High School, Residential Neighborhood

Less preferable due to overall length, special crossings, and easements

Interstate 41 to Moorland Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Interstate 41 to Moorland Road				
	Route M2-2 Sub-Alternatives			
Evaluation Item	M2-2.1	M2-2.2	M2-2.3	M2-2.4
Sub-Alternative Length	25,500 ft	24,700 ft	24,600 ft	22,400 ft
Traffic	Moderate	Low	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	60-115 ft	55-115 ft
Approximate No. of Special Crossings	7	6	6	5
Approximate Special Crossing Length	2,450 ft	2,850 ft	1,750 ft	1,400 ft
No. of Easements	4	3	1	1
Easement Length	3,700 ft	4,300 ft	2,700 ft	2,700 ft
Potential Wetland Impacts	Moderate	Moderate	Low	Low
Constructability	Fair	Fair	Fair	Fair
Existing Utilities	Moderate	Moderate	Moderate	Moderate
Additional Considerations	High School, Golf Course	High School, Golf Course	High School, Residential Neighborhood	High School, Residential Neighborhood

Less preferable due to overall length

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Interstate 41 to Moorland Road: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Interstate 41 to Moorland Road				
Evaluation Item	Route M2-2 Sub-Alternatives			
	M2-2.1	M2-2.2	M2-2.3	M2-2.4
Sub-Alternative Length	25,500 ft	24,700 ft	24,600 ft	22,400 ft
Traffic	Moderate	Low	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	60-115 ft	55-115 ft
Approximate No. of Special Crossings	7	6	6	5
Approximate Special Crossing Length	2,450 ft	2,850 ft	1,750 ft	1,400 ft
No. of Easements	4	3	1	1
Easement Length	3,700 ft	4,300 ft	2,700 ft	2,700 ft
Potential Wetland Impacts	Moderate	Moderate	Low	Low
Constructability	Fair	Fair	Fair	Fair
Existing Utilities	Moderate	Moderate	Moderate	Moderate
Additional Considerations	High School, Golf Course	High School, Golf Course	High School, Residential Neighborhood	High School, Residential Neighborhood

Sub-Alternative M2-2.4	
Advantages	**Disadvantages**
• Shortest length • Within right-of-way (lesser easements) • Lower potential wetland impacts	• Portion of sub-alternative through residential neighborhood

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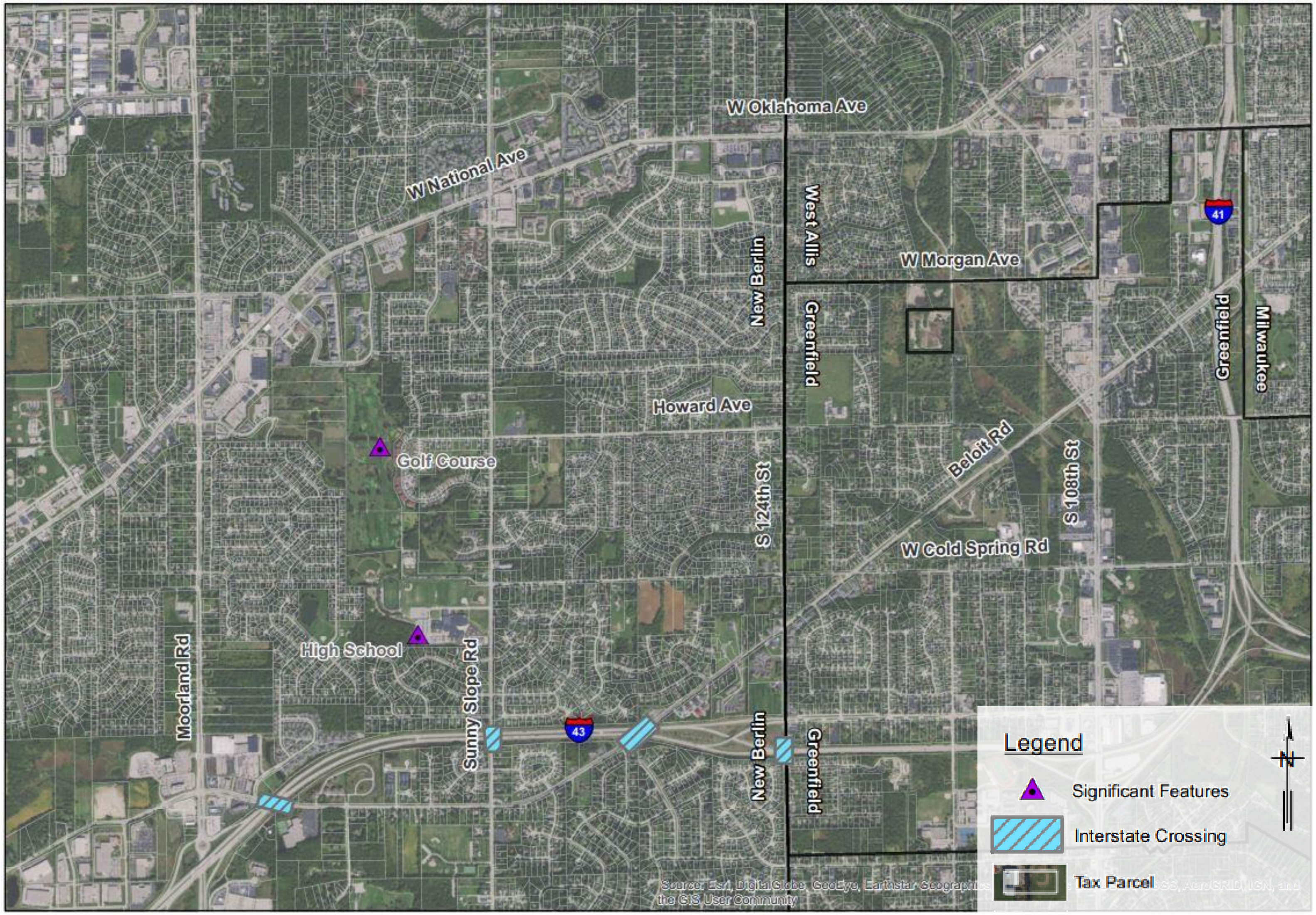
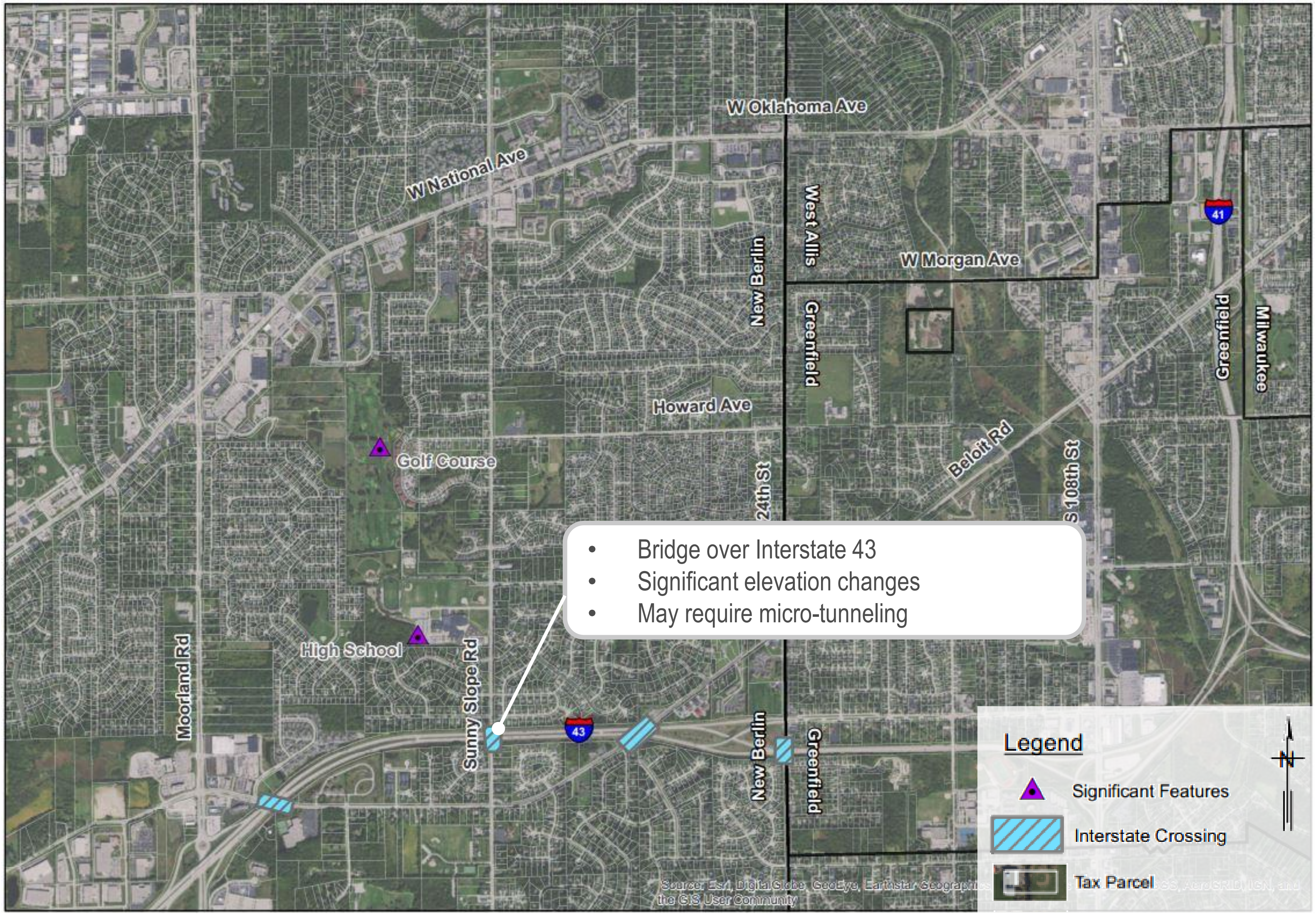
Interstate 41 to Moorland Road: Sub-Alternatives



Interstate 41 to Moorland Road: Sub-Alternatives

Sunny Slope Road: Interstate 43 Crossing, Looking North

Interstate 41 to Moorland Road: Sub-Alternatives



- Bridge over Interstate 43
- Significant elevation changes
- May require micro-tunneling

Interstate 41 to Moorland Road: Sub-Alternatives

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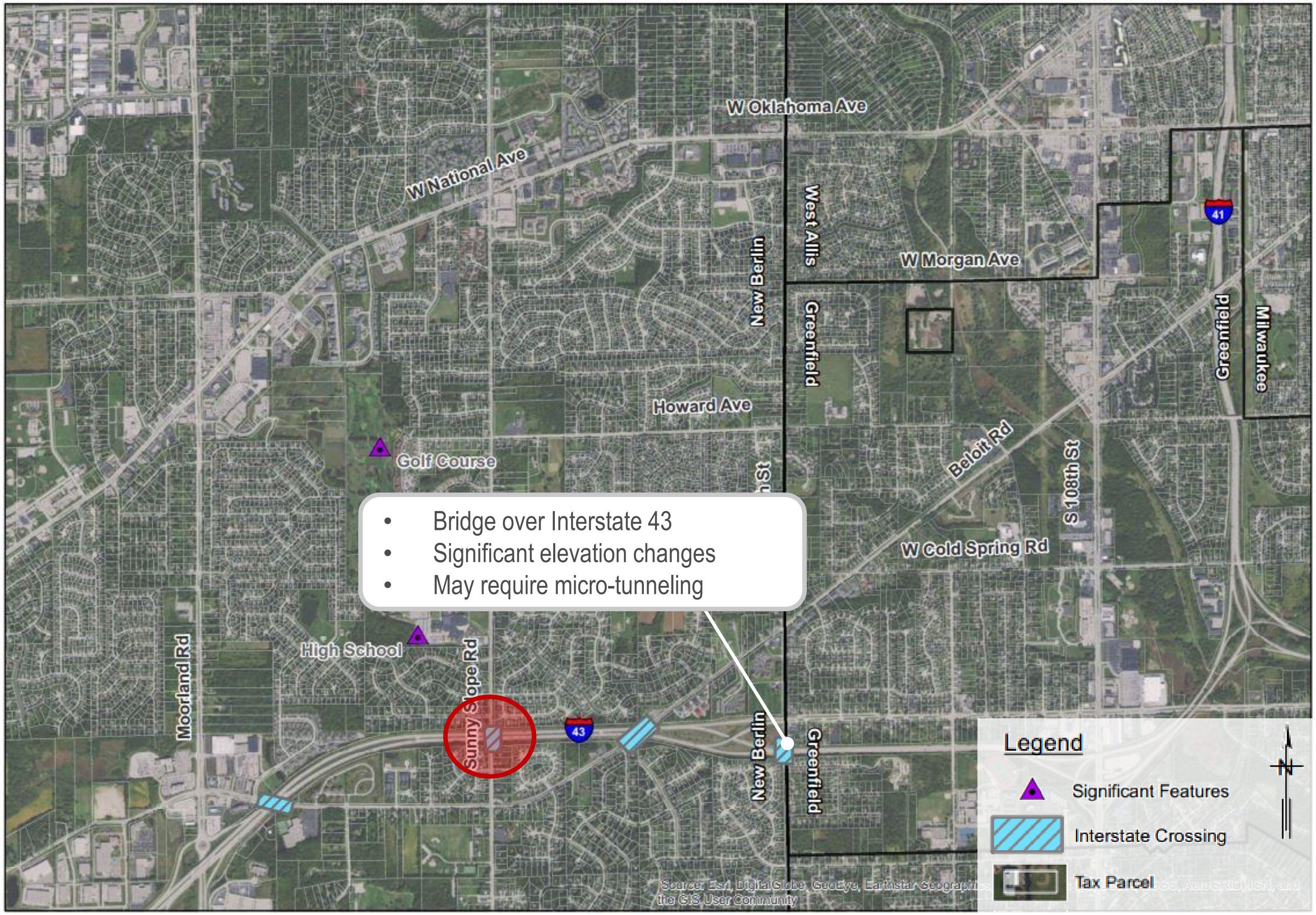
Interstate 41 to Moorland Road: Sub-Alternatives



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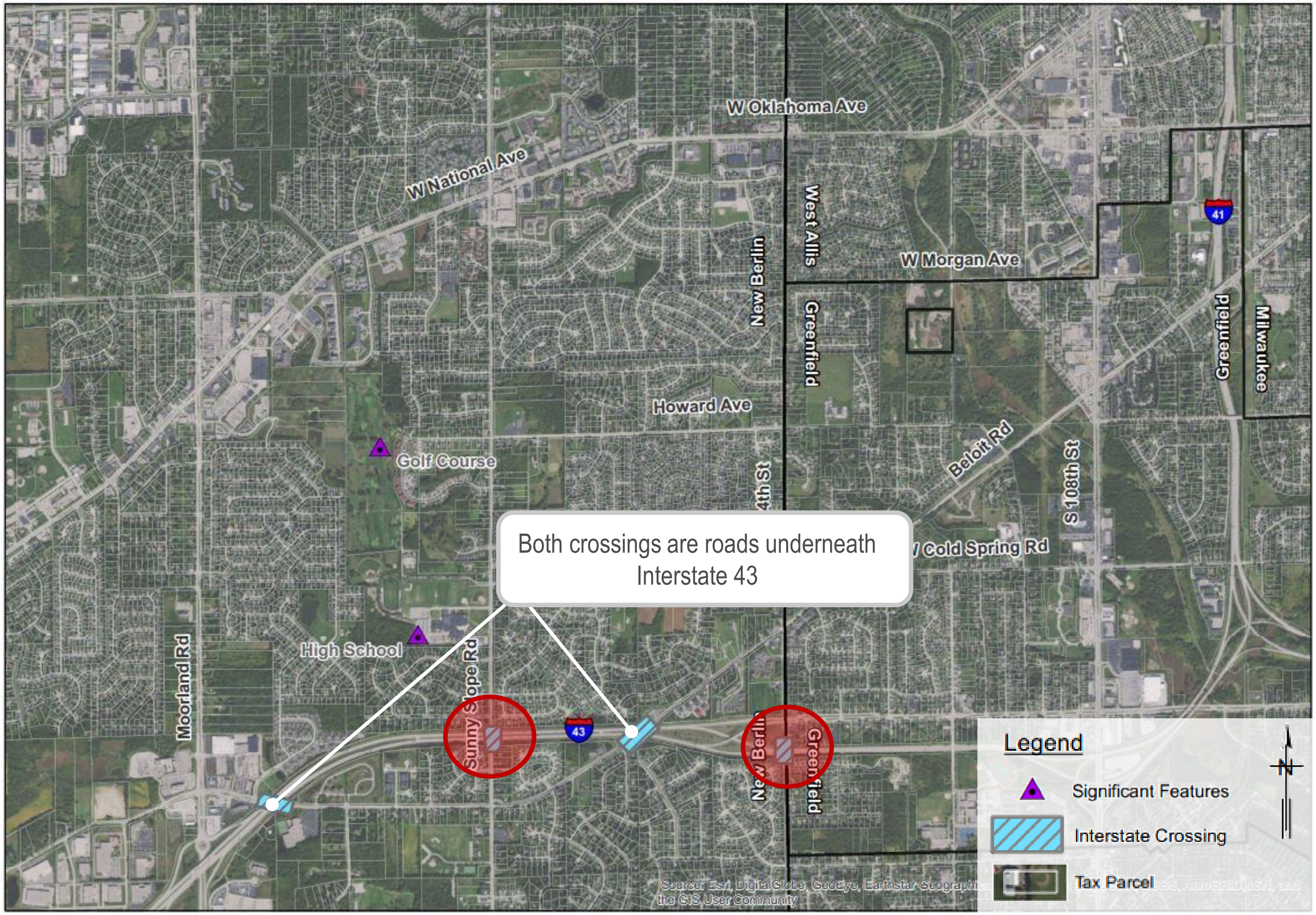
Interstate 41 to Moorland Road: Sub-Alternatives

Beloit Road: Interstate 43 Crossing, Looking Southwest

Interstate 41 to Moorland Road: Sub-Alternatives

Beloit Road: Interstate 43 Crossing, Looking West

60th Street to Interstate 41: Sub-Alternatives



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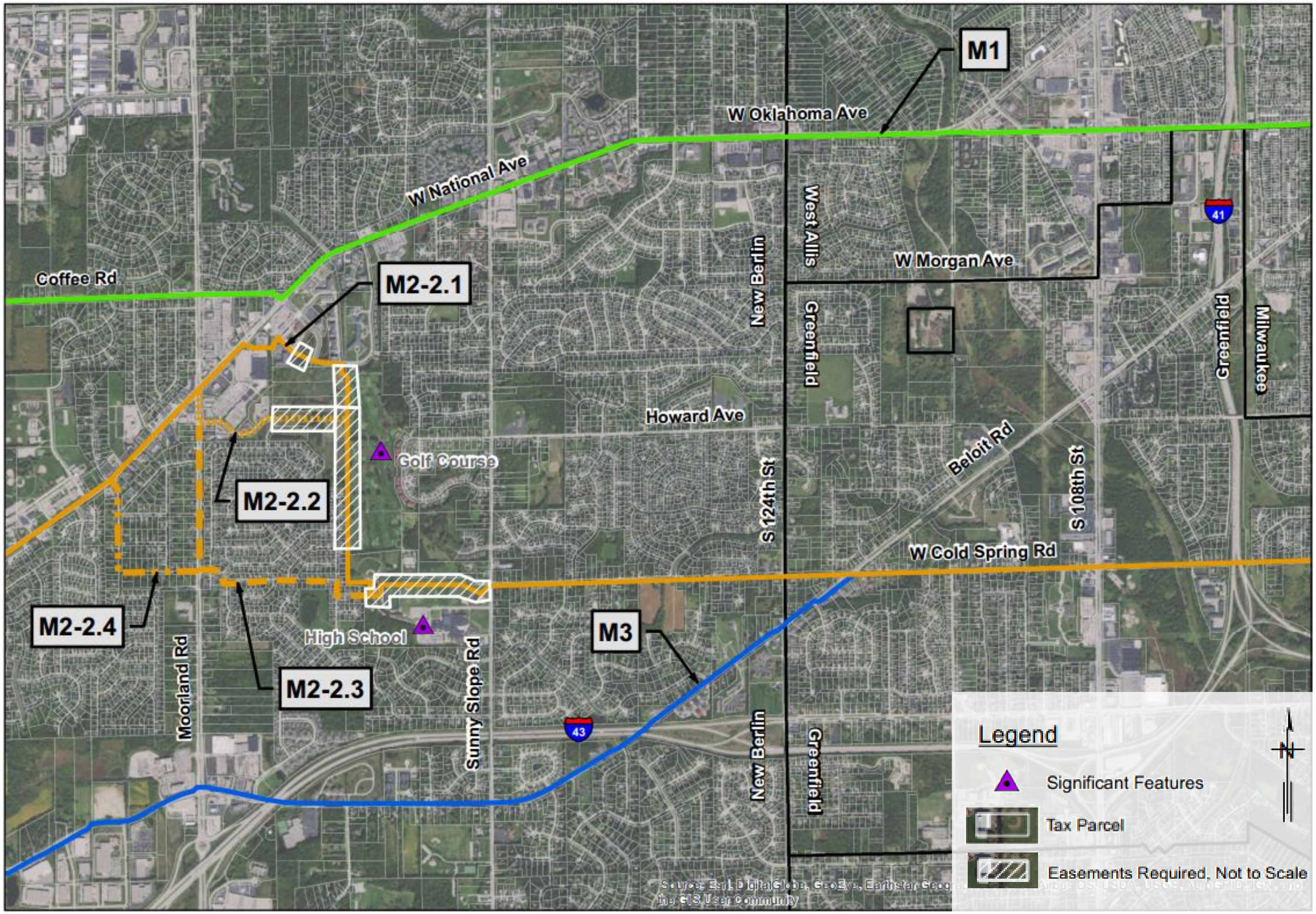
Interstate 41 to Moorland Road: Sub-Alternatives



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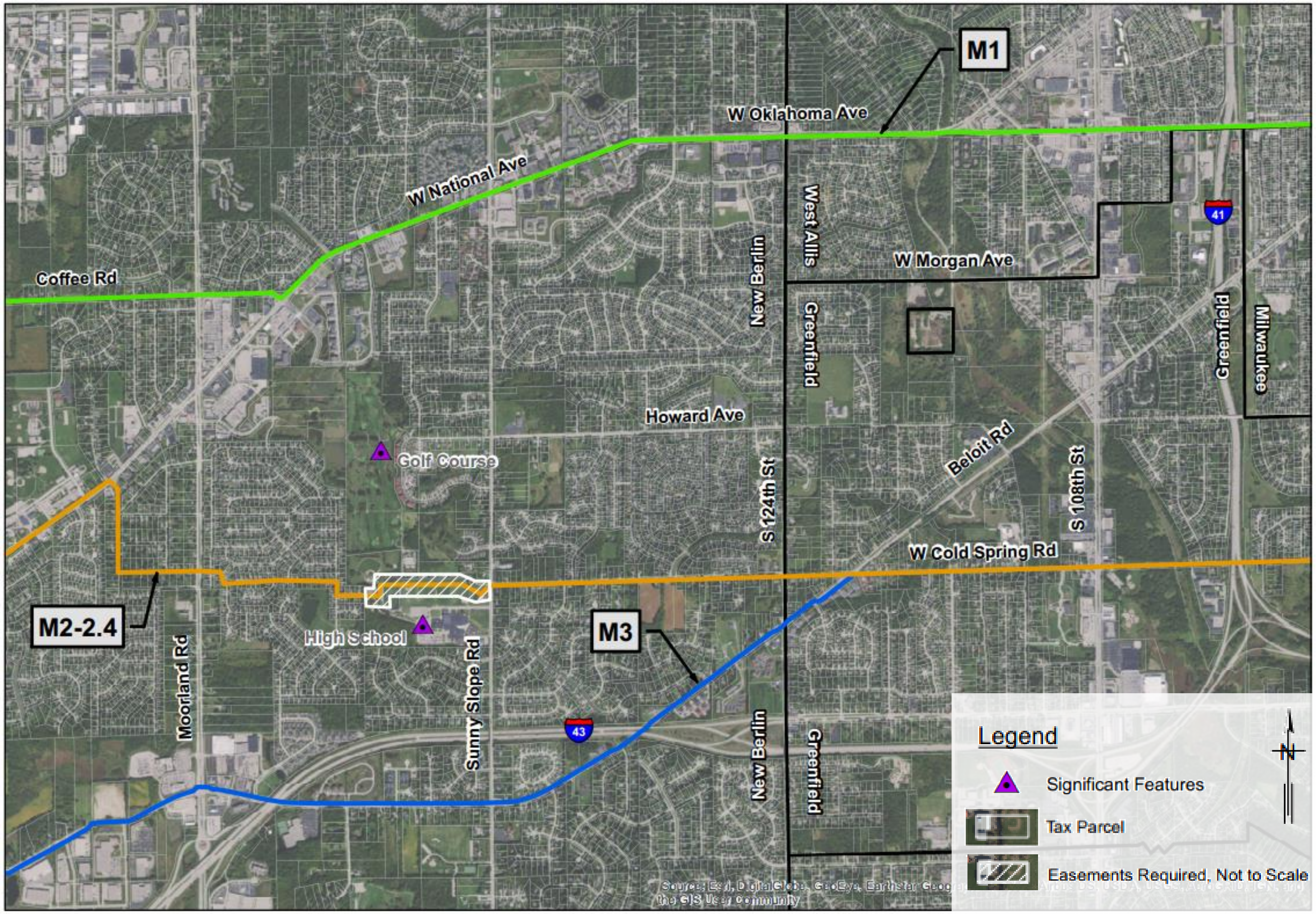
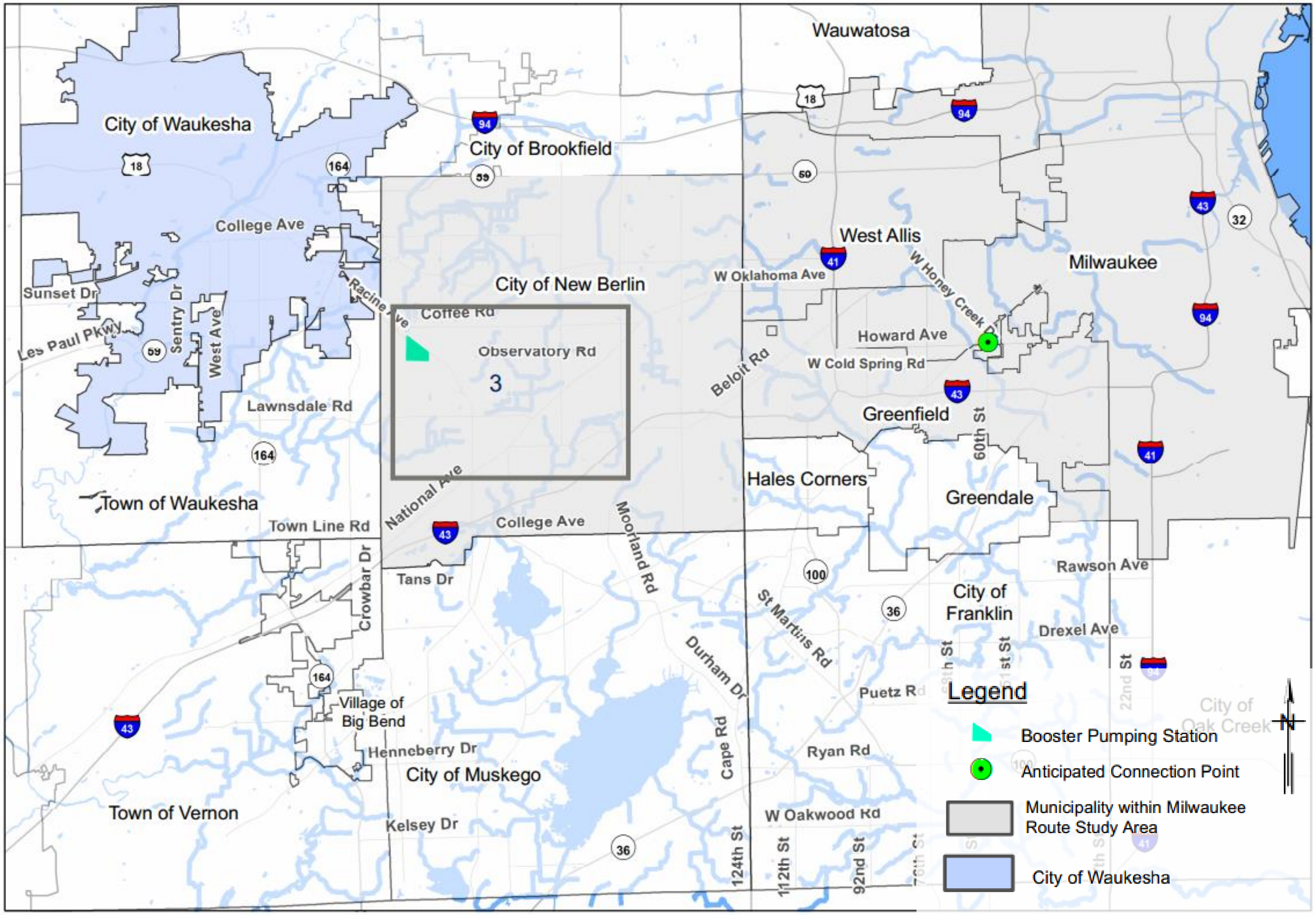
Interstate 41 to Moorland Road: Routes for Further Evaluation



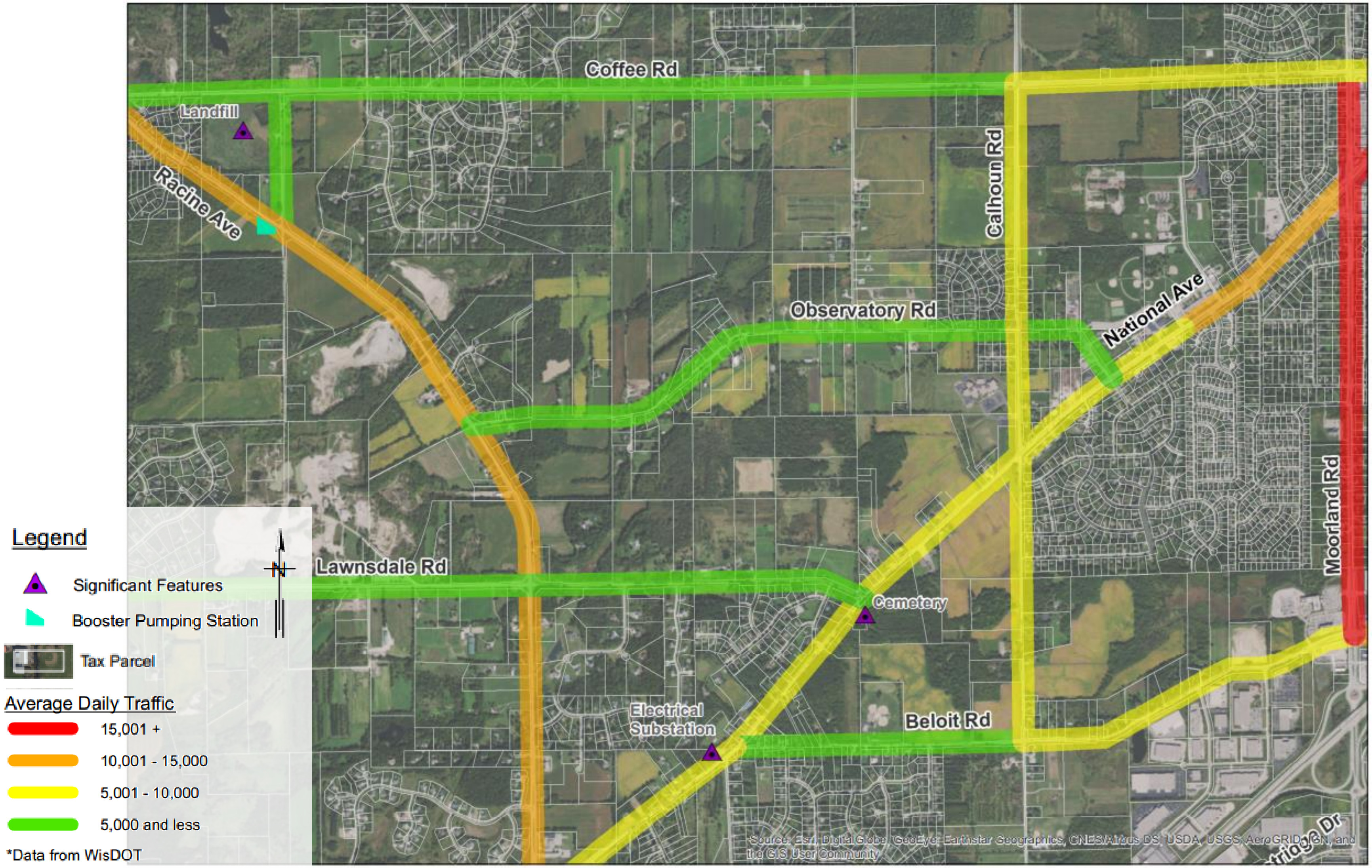
Waukesha Water Utility GREELEY AND HANSEN

Moorland Road to BPS

Moorland Road to BPS: Route Study Area



Moorland Road to BPS: Sub-Alternatives



Waukesha Water Utility

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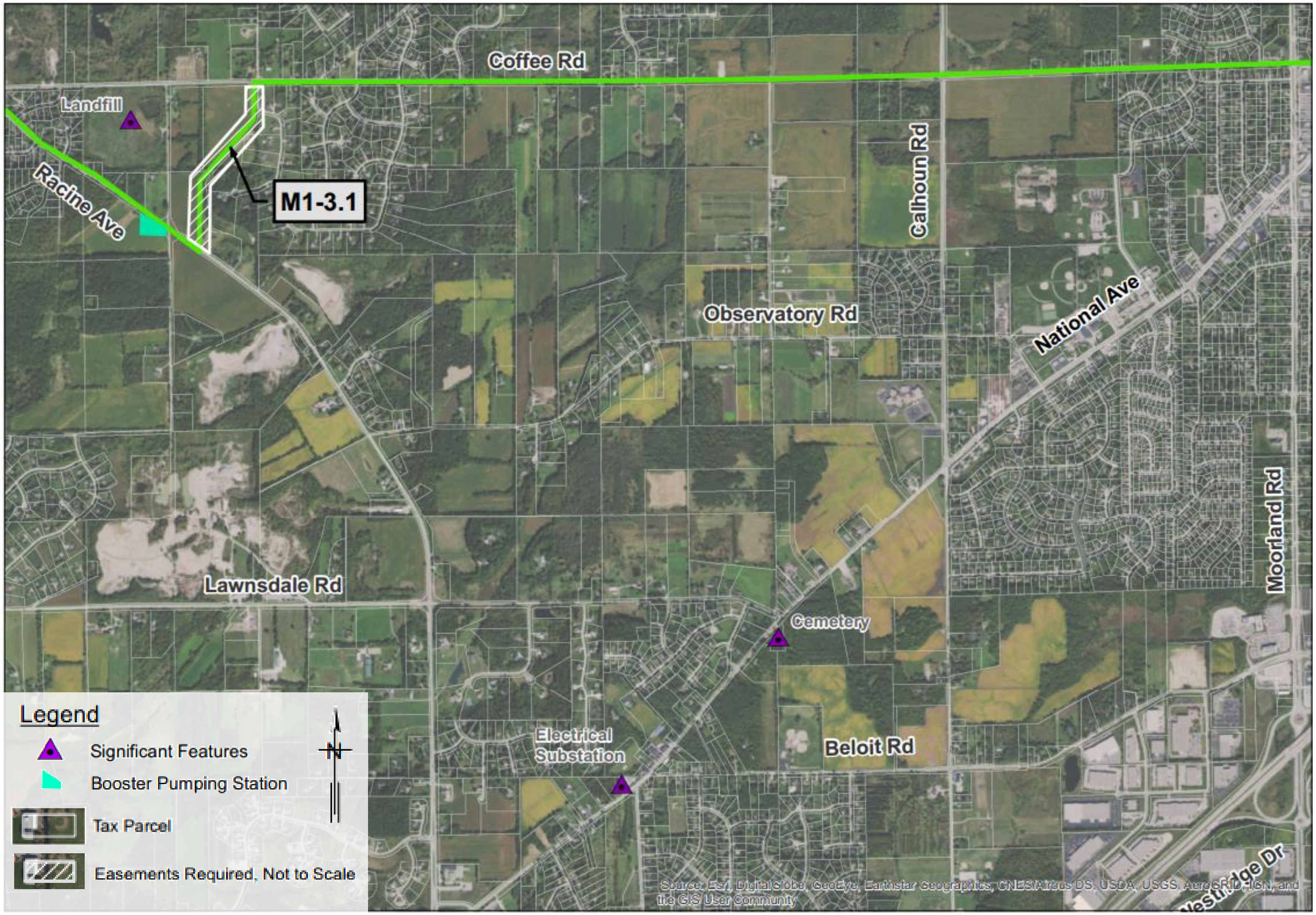
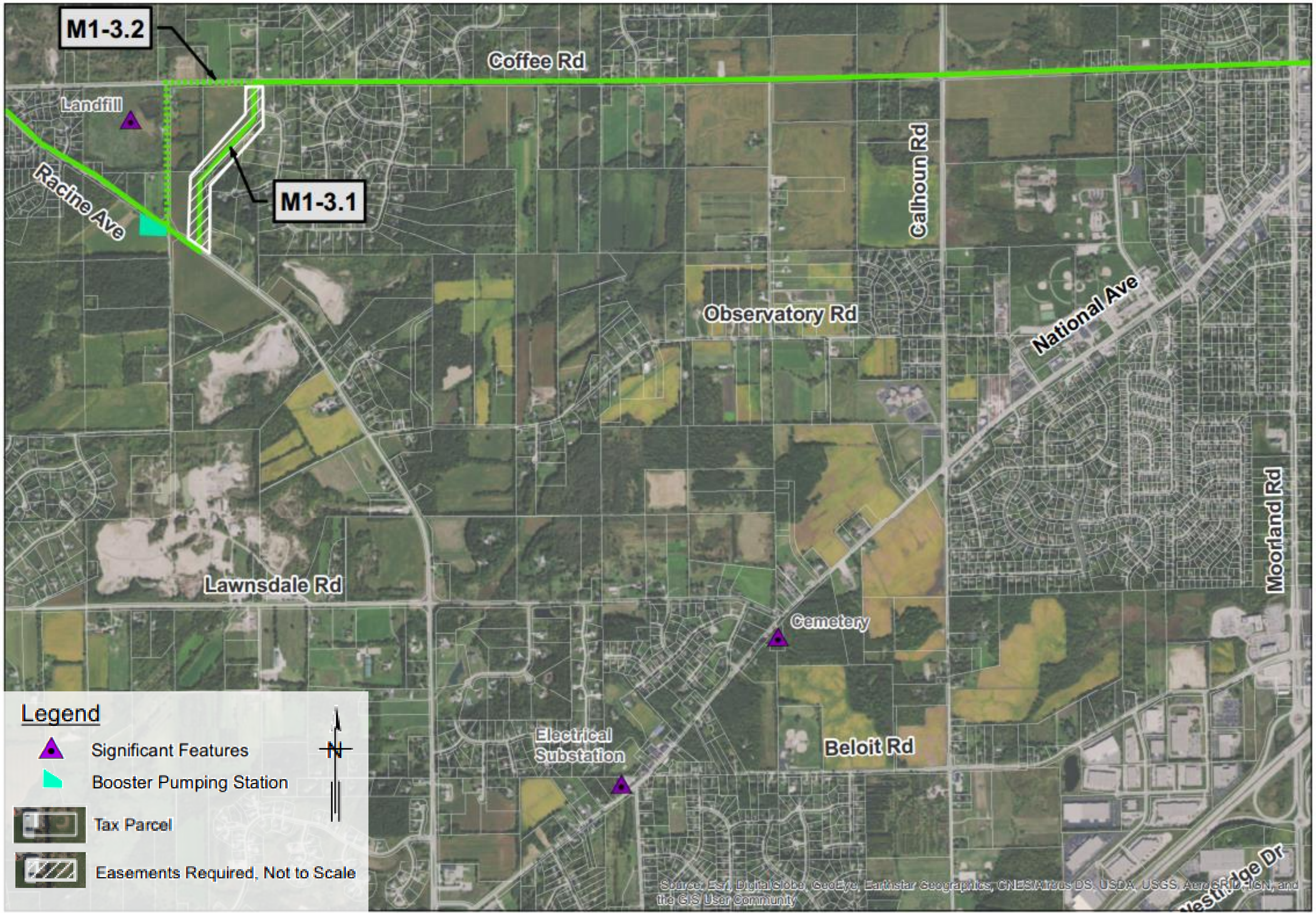
Moorland Road to BPS: Sub-Alternatives



Moorland Road to BPS: Sub-Alternatives



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Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS		
Evaluation Item	Route M1-3 Sub-Alternatives	
	M1-3.1	M1-3.2
Sub-Alternative Length	15,300 ft	15,400 ft
Traffic	Low	Low
Right-of-Way Width	90-110 ft	90-110 ft
No. of Special Crossings	2	2
Approximate Special Crossing Length	350 ft	350 ft
No. of Easements	2	0
Easement Length	2,900	N/A
Potential Wetland Impacts	Low	Low
Constructability	Good	Good
Utility Conflicts	Minimal	Minimal
Additional Considerations	N/A	Landfill

Less preferable due to easements

Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS		
	Route M1-3 Sub-Alternatives	
Evaluation Item	M1-3.1	M1-3.2
Sub-Alternative Length	15,300 ft	15,400 ft
Traffic	Low	Low
Right-of-Way Width	90-110 ft	90-110 ft
No. of Special Crossings	2	2
Approximate Special Crossing Length	350 ft	350 ft
No. of Easements	2	0
Easement Length	2,900	N/A
Potential Wetland Impacts	Low	Low
Constructability	Good	Good
Utility Conflicts	Minimal	Minimal
Additional Considerations	N/A	Landfill

Sub-Alternative M1-3.1

Advantages	Disadvantages
• Overall low traffic • Within right-of-way (no easements)	• Nearby Landfill will require additional soil testing and potentially special gaskets

Moorland Road to BPS: Sub-Alternatives

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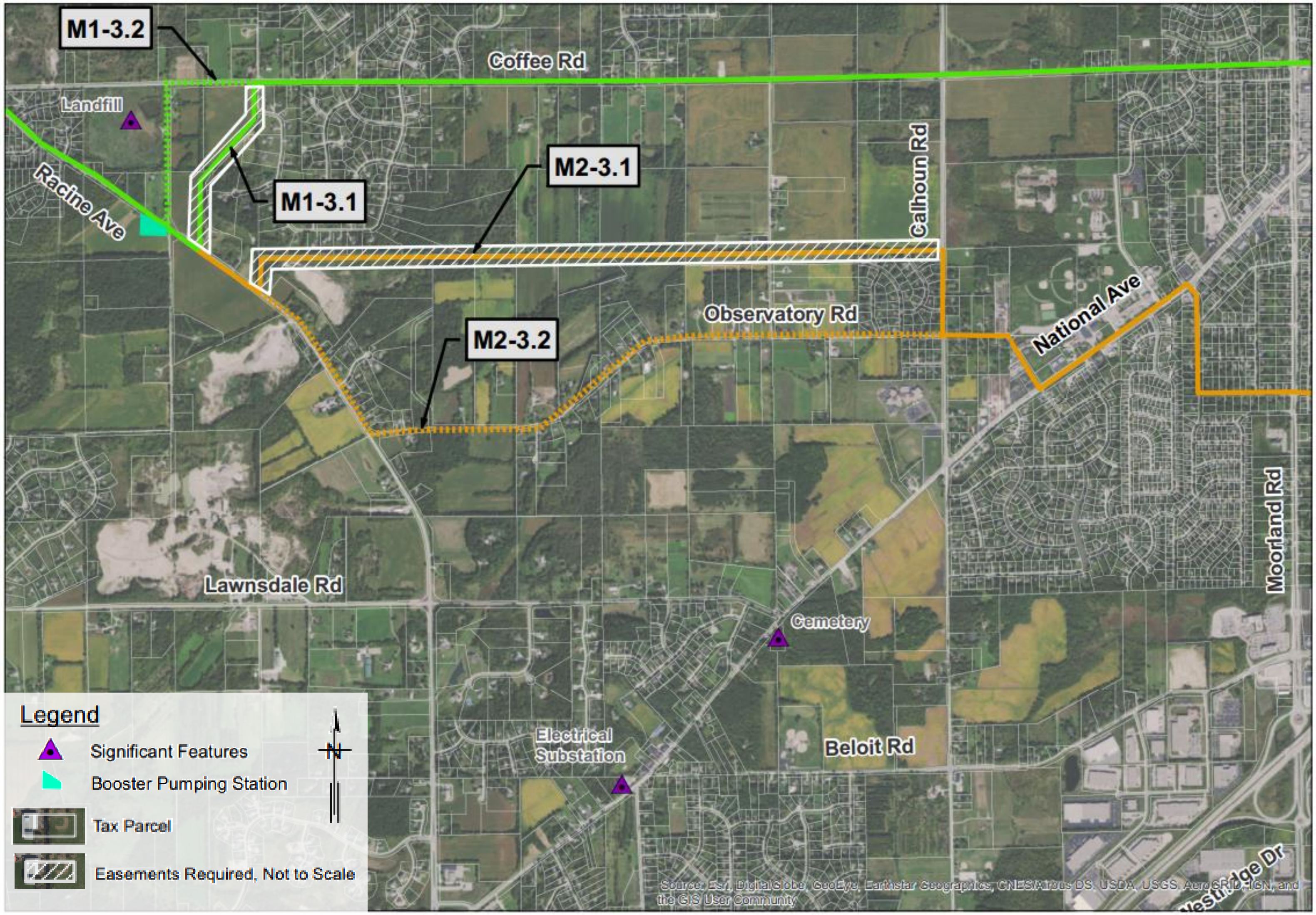
Moorland Road to BPS: Sub-Alternatives



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Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS		
	Route M2-3 Sub-Alternatives	
Evaluation Item	M2-3.1	M2-3.2
Sub-Alternative Length	15,200 ft	15,100 ft
Traffic	Low / Moderate	Low / Moderate
Right-of-Way Width	70-110 ft	55-110 ft
Approximate No. of Special Crossings	2	2
Approximate Special Crossing Length	550	550
No. of Easements	8	0
Easement Length	10,900 ft	N/A
Potential Wetland Impacts	Low	Moderate
Constructability	Fair	Fair
Existing Utilities	Minimal	Minimal
Additional Considerations	N/A	N/A

Less preferable due to easements

Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS		
Evaluation Item	Route M2-3 Sub-Alternatives	
	M2-3.1	M2-3.2
Sub-Alternative Length	15,200 ft	15,100 ft
Traffic	Low / Moderate	Low / Moderate
Right-of-Way Width	70-110 ft	55-110 ft
Approximate No. of Special Crossings	2	2
Approximate Special Crossing Length	550	550
No. of Easements	8	0
Easement Length	10,900 ft	N/A
Potential Wetland Impacts	Low	Moderate
Constructability	Fair	Fair
Existing Utilities	Minimal	Minimal
Additional Considerations	N/A	N/A

Sub-Alternative M2-3.1	
Advantages	**Disadvantages**
• Within right-of-way (no easements) • Shorter length	• Narrower right-of-way width, on average

Moorland Road to BPS: Sub-Alternatives

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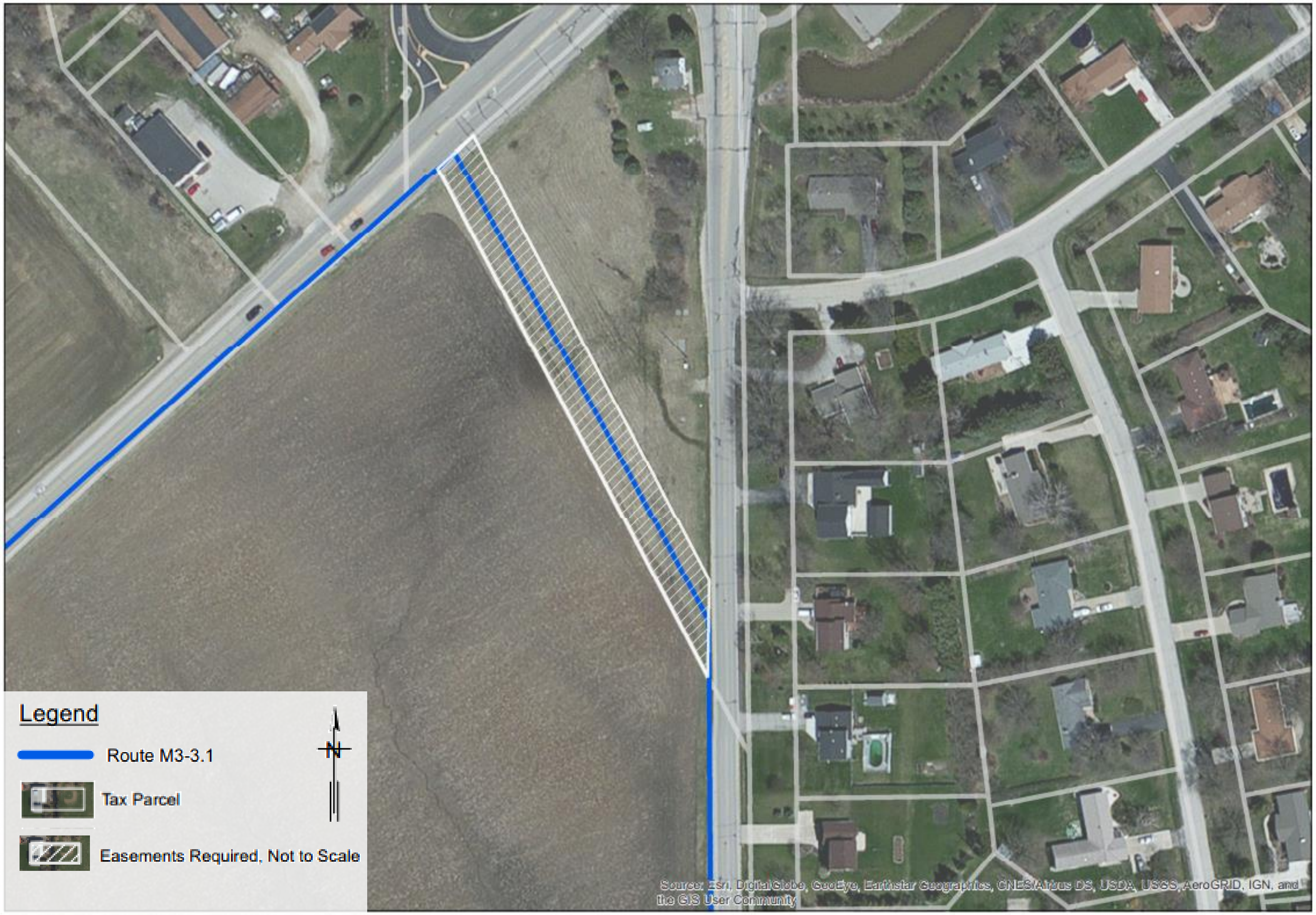
Moorland Road to BPS: Sub-Alternatives



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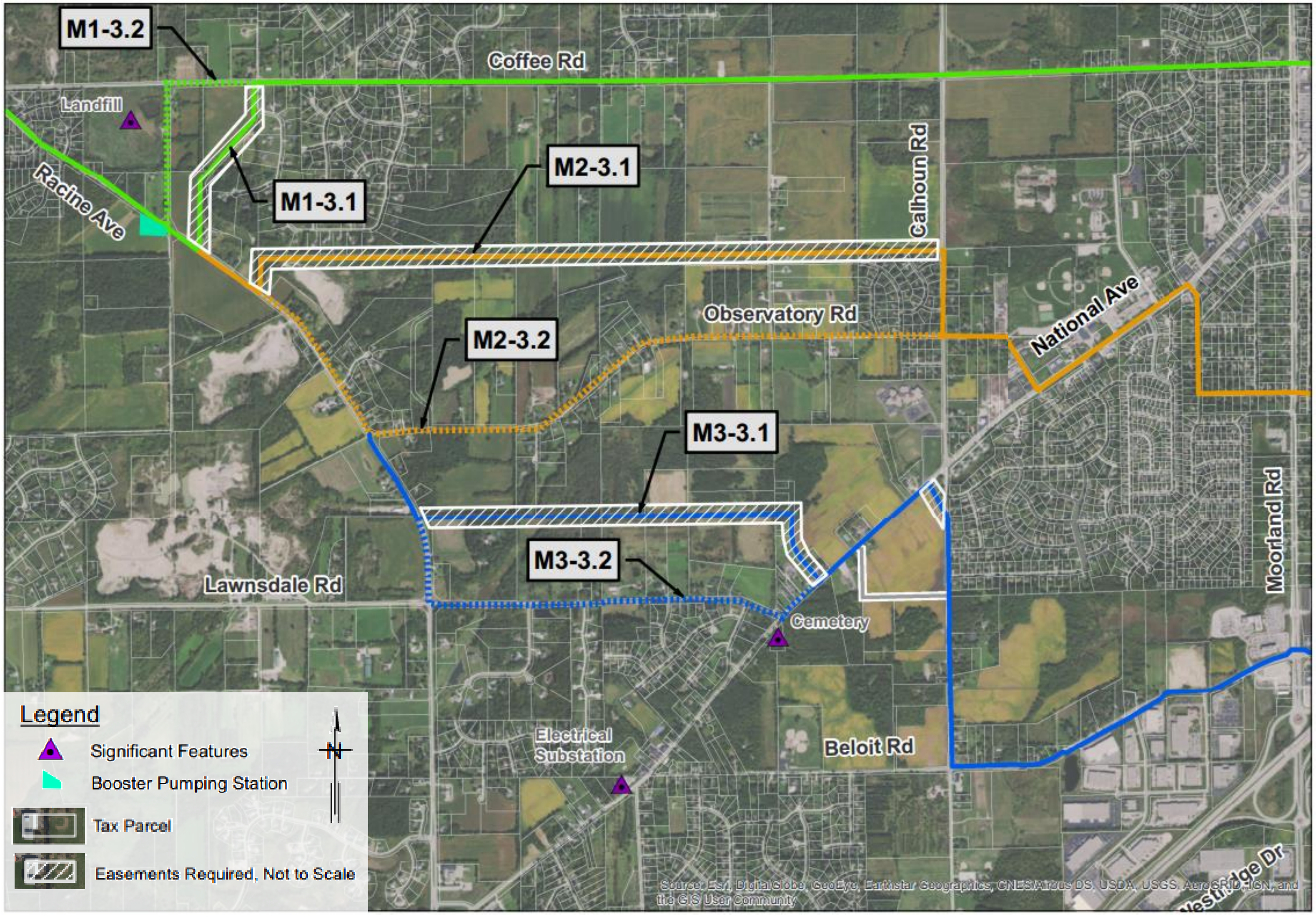
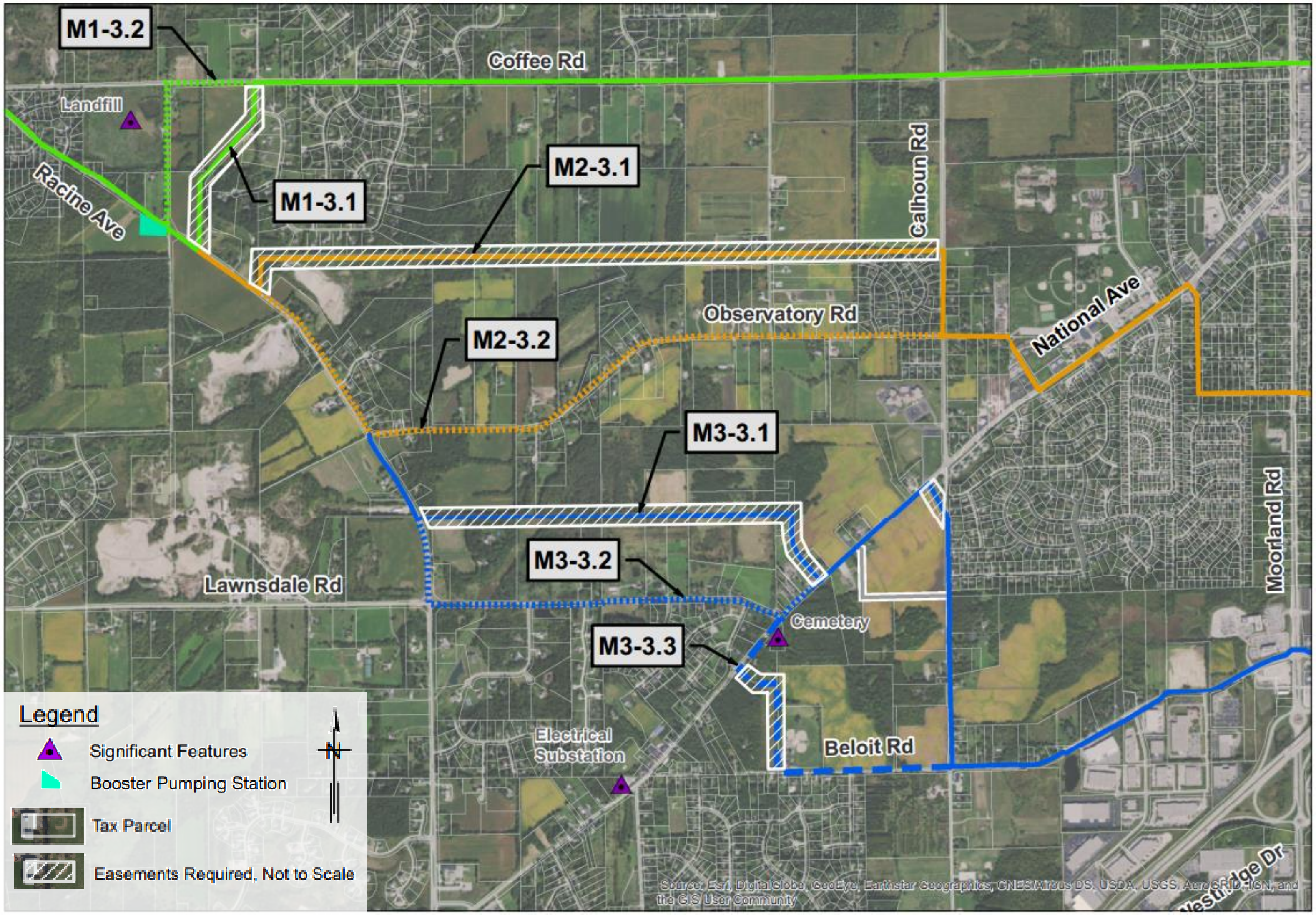
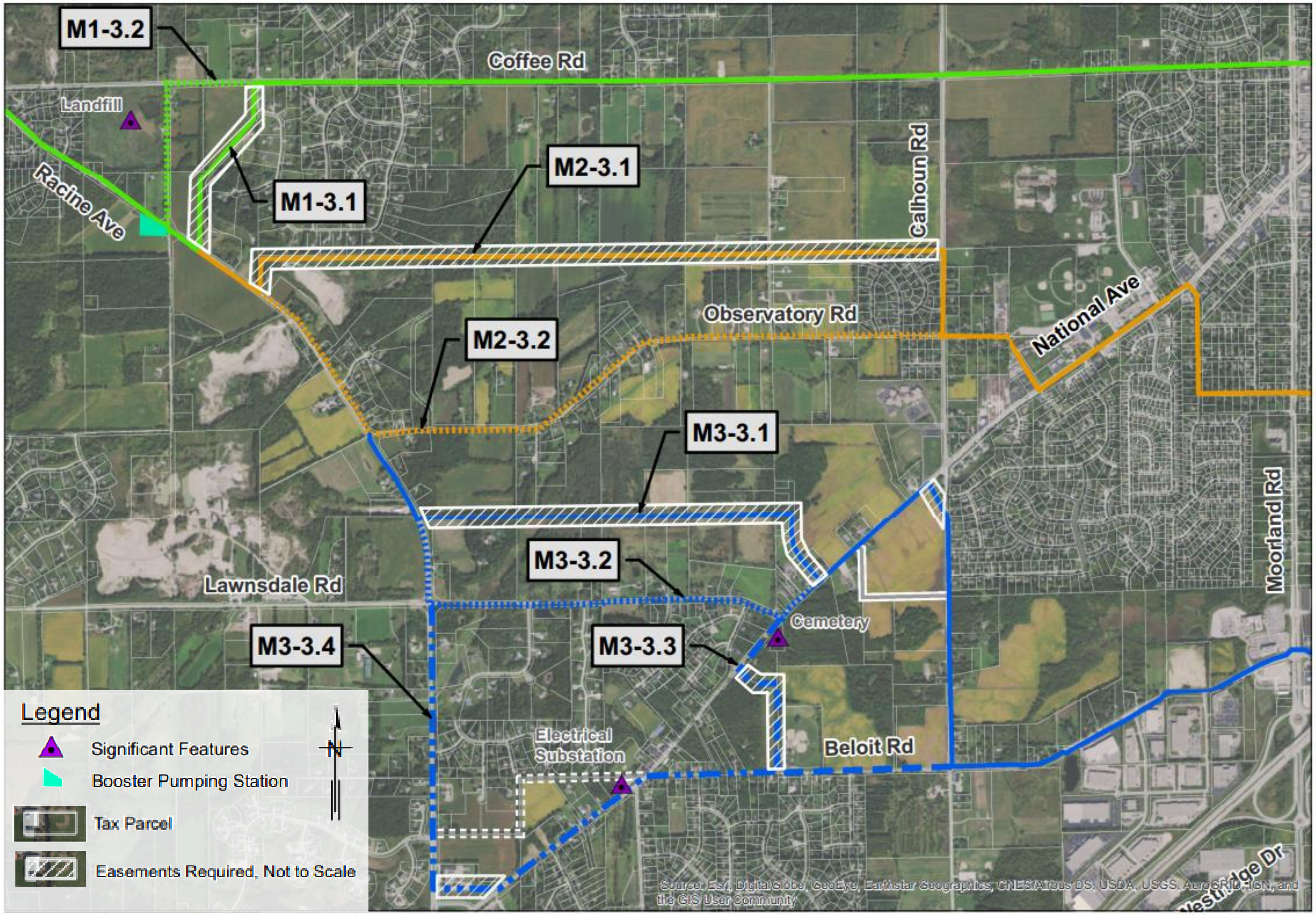
Moorland Road to BPS: Sub-Alternatives



Moorland Road to BPS: Sub-Alternatives



Moorland Road to BPS: Sub-Alternatives



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Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS				
	Route M3-3 Sub-Alternatives			
Evaluation Item	M3-3.1	M3-3.2	M3-3.3	M3-3.4
Sub-Alternative Length	20,400 ft	21,100 ft	19,500 ft	21,200 ft
Traffic	Low	Moderate	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	55-115 ft	60-115 ft
Approximate No. of Special Crossings	2	2	2	2
Approximate Special Crossing Length	500 ft	500 ft	500 ft	500 ft
No. of Easements	8	1	1	1
Easement Length	7,400 ft	1,600 ft	1,300	1,700
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Fair	Fair	Fair	Good
Existing Utilities	Minimal	Minimal	Minimal	Moderate
Additional Considerations	N/A	Stakeholder Challenges	Cemetery, Stakeholder Challenges	Electrical Substation

Less preferable due to easements

Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS				
	Route M3-3 Sub-Alternatives			
Evaluation Item	M3-3.1	M3-3.2	M3-3.3	M3-3.4
Sub-Alternative Length	20,400 ft	21,100 ft	19,500 ft	21,200 ft
Traffic	Low	Moderate	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	55-115 ft	60-115 ft
Approximate No. of Special Crossings	2	2	2	2
Approximate Special Crossing Length	500 ft	500 ft	500 ft	500 ft
No. of Easements	8	1	1	1
Easement Length	7,400 ft	1,600 ft	1,300	1,700
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Fair	Fair	Fair	Good
Existing Utilities	Minimal	Minimal	Minimal	Moderate
Additional Considerations	N/A	Stakeholder Challenges	Cemetery, Stakeholder Challenges	Electrical Substation

Less preferable due to Stakeholder Challenges, and constructability

Waukesha Water Utility

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Moorland Road to BPS: Sub-Alternative Comparison

Sub-Alternatives Evaluation: Moorland Road to BPS				
	Route M3-3 Sub-Alternatives			
Evaluation Item	M3-3.1	M3-3.2	M3-3.3	M3-3.4
Sub-Alternative Length	20,400 ft	21,100 ft	19,500 ft	21,200 ft
Traffic	Low	Moderate	Low	Moderate
Right-of-Way Width	60-115 ft	55-115 ft	55-115 ft	60-115 ft
Approximate No. of Special Crossings	2	2	2	2
Approximate Special Crossing Length	500 ft	500 ft	500 ft	500 ft
No. of Easements	8	1	1	1
Easement Length	7,400 ft	1,600 ft	1,300	1,700
Potential Wetland Impacts	Low	Low	Low	Low
Constructability	Fair	Fair	Fair	Good
Existing Utilities	Minimal	Minimal	Minimal	Moderate
Additional Considerations	N/A	Stakeholder Challenges	Cemetery, Stakeholder Challenges	Electrical Substation

Sub-Alternative M3-3.2	
Advantages	**Disadvantages**
• Good constructability • Wider right-of-way, on average • Only easement through abandoned school property	• Portion within easement • Moderate traffic • Electrical substation near alignment • Moderate potential for existing utilities

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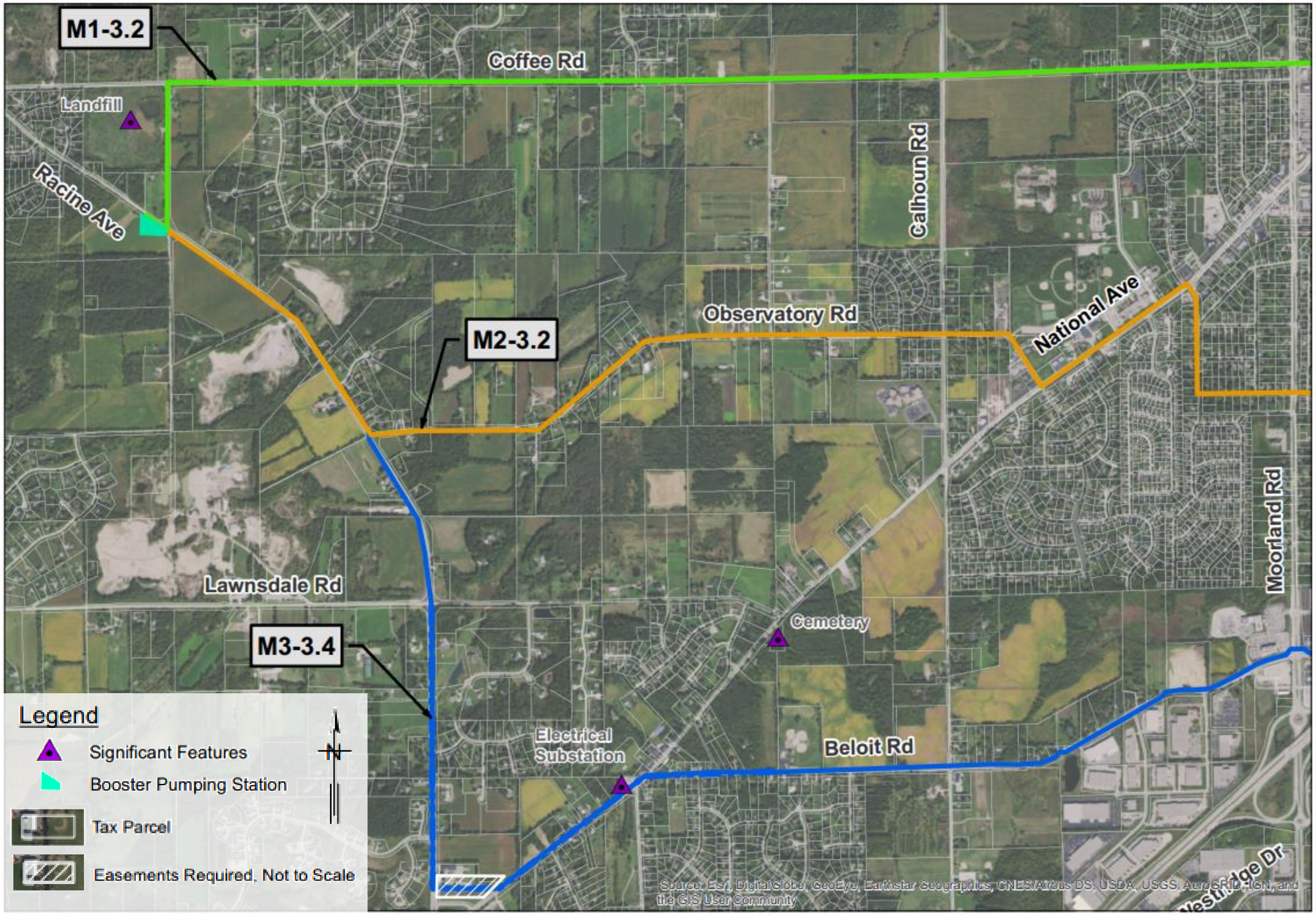
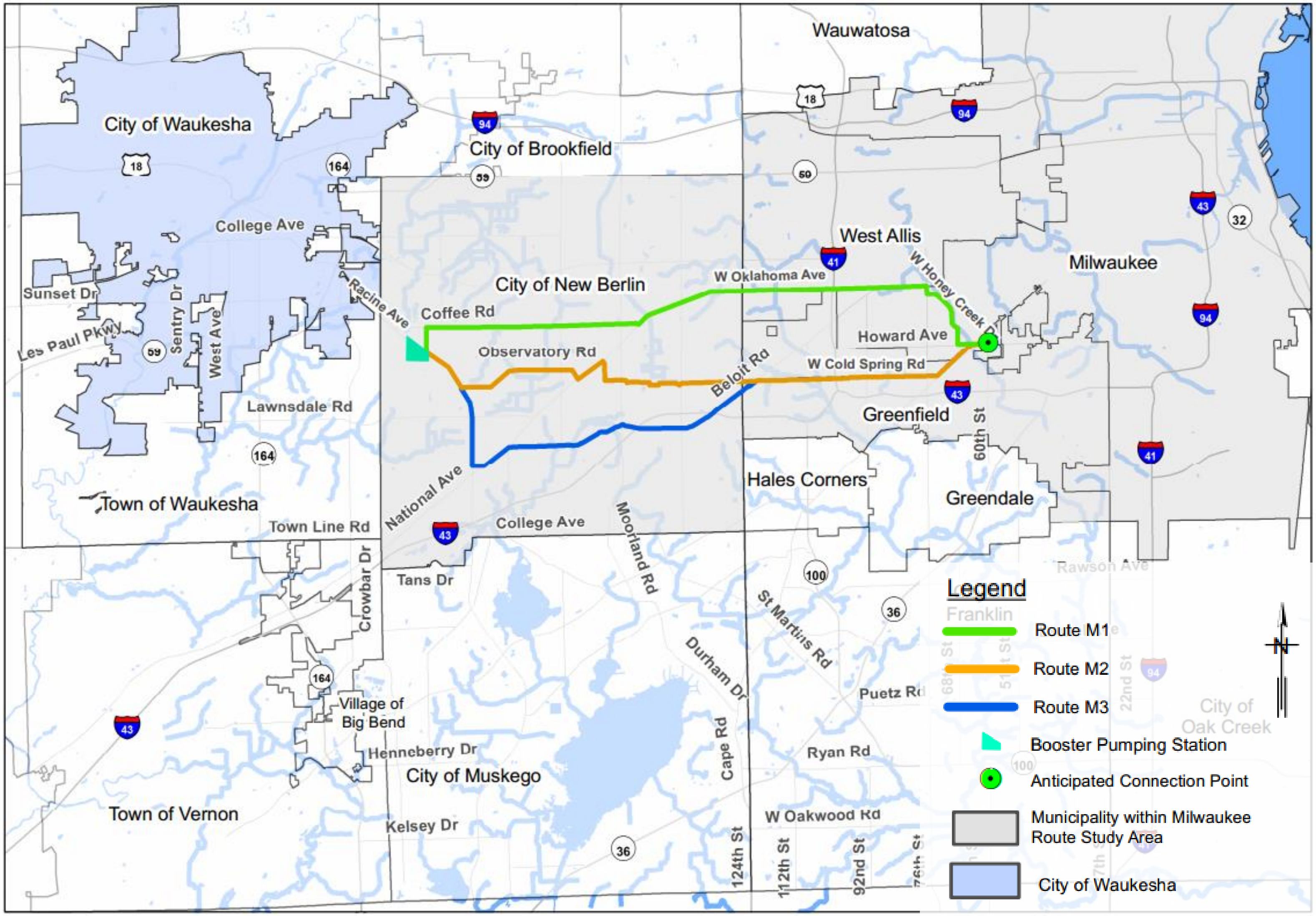
Moorland Road to BPS: Routes for Further Evaluation



Waukesha Water Utility GREELEY AND HANSEN

Summary Wrap-Up and Action Items

Summary Wrap-Up and Action Items



Summary Wrap-Up and Action Items

- DEL 4-100 D2 Route Study: Milwaukee
  - Standalone document
  - Draft outline (handout)

Summary Wrap-Up and Action Items

- Reviewed the Route Development Constraints, including the:
  - Starting and ending points;
  - Planned Regional Transportation Projects; and,
  - Route Study Area.
- Gained Consensus on the Routes between 60th Street and Interstate 41, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.

Summary Wrap-Up and Action Items

- Gained Consensus on the Routes between Interstate 41 and Moorland Road, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.
- Gained Consensus on the Routes between Moorland Road and the BPS, including the:
  - Sub-alternatives identified;
  - Sub-alternatives comparison; and,
  - Routes for further evaluation.
- Gained Consensus that DEL 4-100 D2 Route Study: Milwaukee Will Be a Standalone Document. Share Draft Outline for Review.

THANK YOU

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MEETING SUMMARY

The Great Water Alliance (Program) Route Study Meeting on the preliminary preferred Water Supply Route was held in the Waukesha Water Utility (WWU) Large Conference Room at 9:30 a.m. on February 16, 2018. The purpose of the meeting was to summarize the Route Study and identify the preliminary preferred Water Supply Pipeline route. The attendees are listed on the attached sign-in sheet. The agenda and presentation materials are attached.

	Action Item	Action By	Due Date
1.	Add electrical transmission utility corridor as a sub-alternative for the Draft Route Study: Milwaukee (DEL 4-100 D2).	T. Bluver	**2/23/18**

1) **Welcome**
   a) The agenda, meeting objectives, and key work recently performed were discussed.

2) **Non-Economic Analysis**
   a) Route Alternatives were evaluated based on non-economic criteria.
   b) Route Alternative M1 minimizes constructability challenges relative to the other route alternatives.
   c) Route Alternative M1 is more preferable on a non-economic basis.

3) **Economic Analysis**
   a) Route Alternatives were evaluated based on economic criteria.
   b) Route Alternative M1 has a lower Class 4 Opinion of Probable Construction Cost than the other route alternatives. Route Alternatives M2 and M3 have risks of higher capital costs due the potential for additional surface restoration, utility relocation, and suspected existing utilities through narrower corridors. Use of the east-west electrical transmission utility corridor between Forest Home Avenue and 94th Street would not make Route Alternatives M2 or M3 less costly than Route Alternative M1.

4) **Route Scoring**
   a) Route alternatives were scored based on findings from the non-economic and economic evaluations.
   b) Route Alternative M1 is more preferable than Route Alternatives M2 and M3.

5) **Summary Wrap-Up and Action Items**
   a) Discussions with Milwaukee Water Works (MWW) have indicated the anticipated Water Supply Pumping Station (WSPS) and MWW distribution system connection would not be a differentiating factor in identifying the preferred route alternative.
   b) The Draft Route Study: Milwaukee (DEL 4-100 D2) will proceed utilizing the anticipated location for the WSPS and connection to MWW's distribution system at 60th Street and Howard Avenue. To maintain schedule, a Draft Route Study: Milwaukee (DEL 4-100 D2) will be submitted with route alternatives aligned to this location before the locations are confirmed with MWW, if needed. A second draft would be shared with WWU updated per comments received and with the route alternatives refined to accommodate the final WSPS location and connection point to MWW's distribution system.
   c) Key action items are summarized in the table on Page 1 of this Summary.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER
ALLIANCE

ROUTE STUDY MEETING: PRELIMINARY PREFERRED WATER SUPPLY ROUTE
SIGN-IN SHEET

February 16, 2018

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Chris Walter	Waukesha Water Utility	
3	Kelly Zylstra	Waukesha Water Utility	
4	Ted Bluver	Greeley and Hansen	
5	Ryan Christopher	Greeley and Hansen	
6	Katie Richardson	Greeley and Hansen	
7	Nicole Spieles	Greeley and Hansen	
8	Connor Wraight	Greeley and Hansen	
9	Kevin Richardson	Kevin Richardson Consulting	
10			
11			
12			

Date/Time: February 16, 2018, 9:30 a.m. – 11:00 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Chris Walter, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Ryan Christopher, GH
Katie Richardson, GH
Nicole Spieles, GH
Connor Wraight, GH
Kevin Richardson, KRC

Time	Topic	Presenter(s)
9:30 a.m.	Welcome - Agenda Overview (Handout) - Meeting Objectives - Key Work Recently Performed	Katie Richardson; Ted Bluver
9:35 a.m.	Non-Economic Analysis	Ted Bluver; Connor Wraight
10:15 a.m.	Economic Analysis	Connor Wraight
10:40 a.m.	Route Scoring - Key Performance Indicator Metrics - Triple Bottom Line Analysis - Preliminary Preferred Water Supply Route	Katie Richardson
10:50 a.m.	Summary Wrap-Up and Action Items	Ted Bluver
11:00 a.m.	Adjourn	

Great Lakes Water Supply Program

Great Water Alliance | Task 4-100 Meeting No. 5

Route Study Meeting: Preliminary Preferred Water Supply Route

February 16, 2018

GREAT WATER ALLIANCE™

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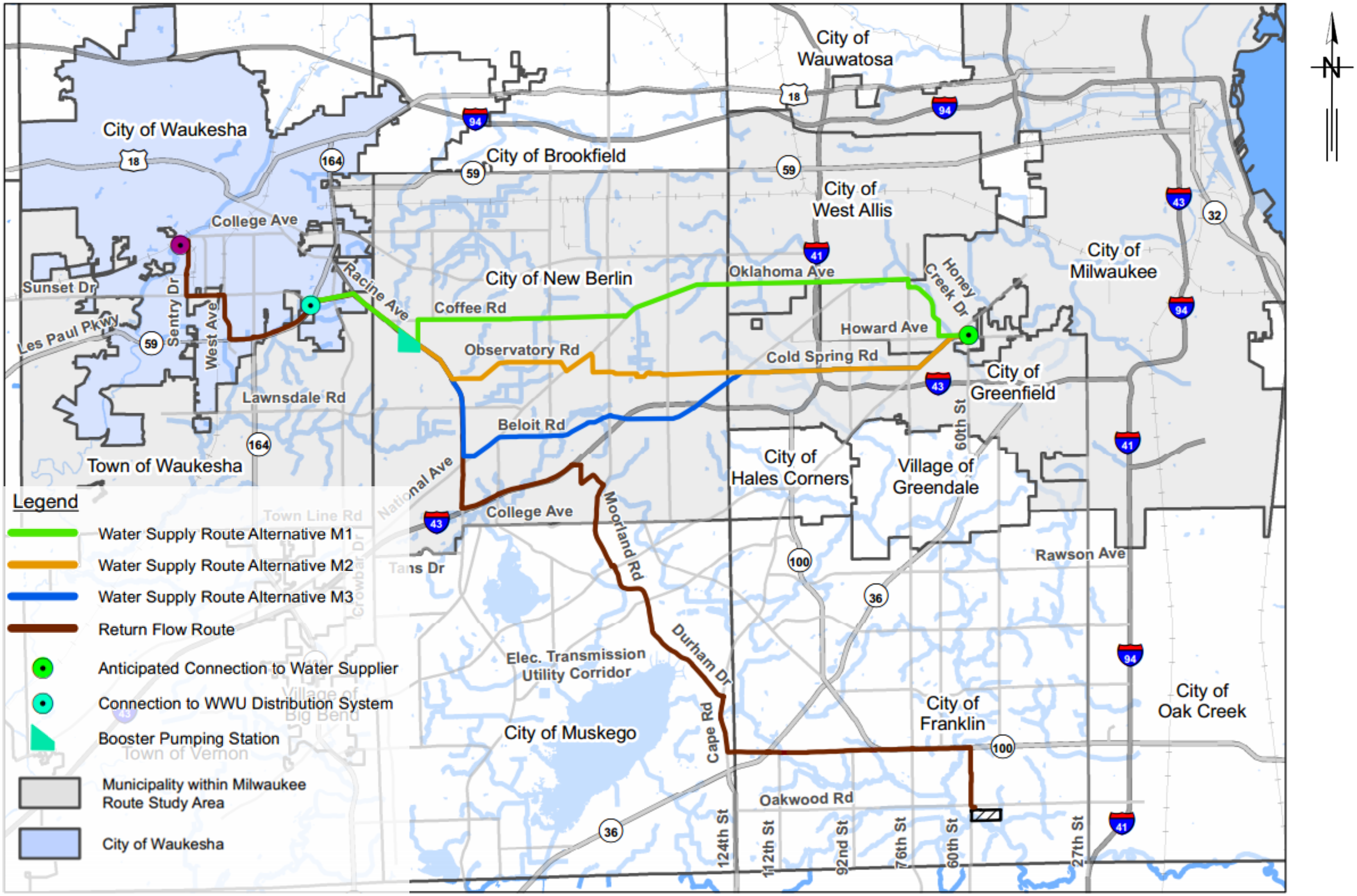
Meeting Objectives

- Review Non-Economic Analysis for Route Alternatives
- Review Economic Analysis for Route Alternatives
- Present Route Scores and Gain Consensus on the Preliminary Preferred Water Supply Route

Key Work Recently Performed



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Key Work Recently Performed

- Submitted Oak Creek Route Study
- Compared Route Alternatives Based on Non-Economic Analysis
- Compared Route Alternatives Based on Economic Analysis
- Scored Route Alternatives and Identified the Preliminary Preferred Water Supply Route
- Further Developed the Milwaukee Route Study and Preliminary Design Report

Non-Economic Analysis

Non-Economic Analysis:
Pipeline Lengths and Special Crossings

Pipeline Lengths and Special Crossings			
	Route Alternatives		
Evaluation Item	M1	M2	M3
*Total Pipeline Length	68,900 LF	67,000 LF	72,100 LF
Number of Special Crossings	23	22	24
Total Special Crossings Length	5,900 LF	5,200 LF	6,400 LF

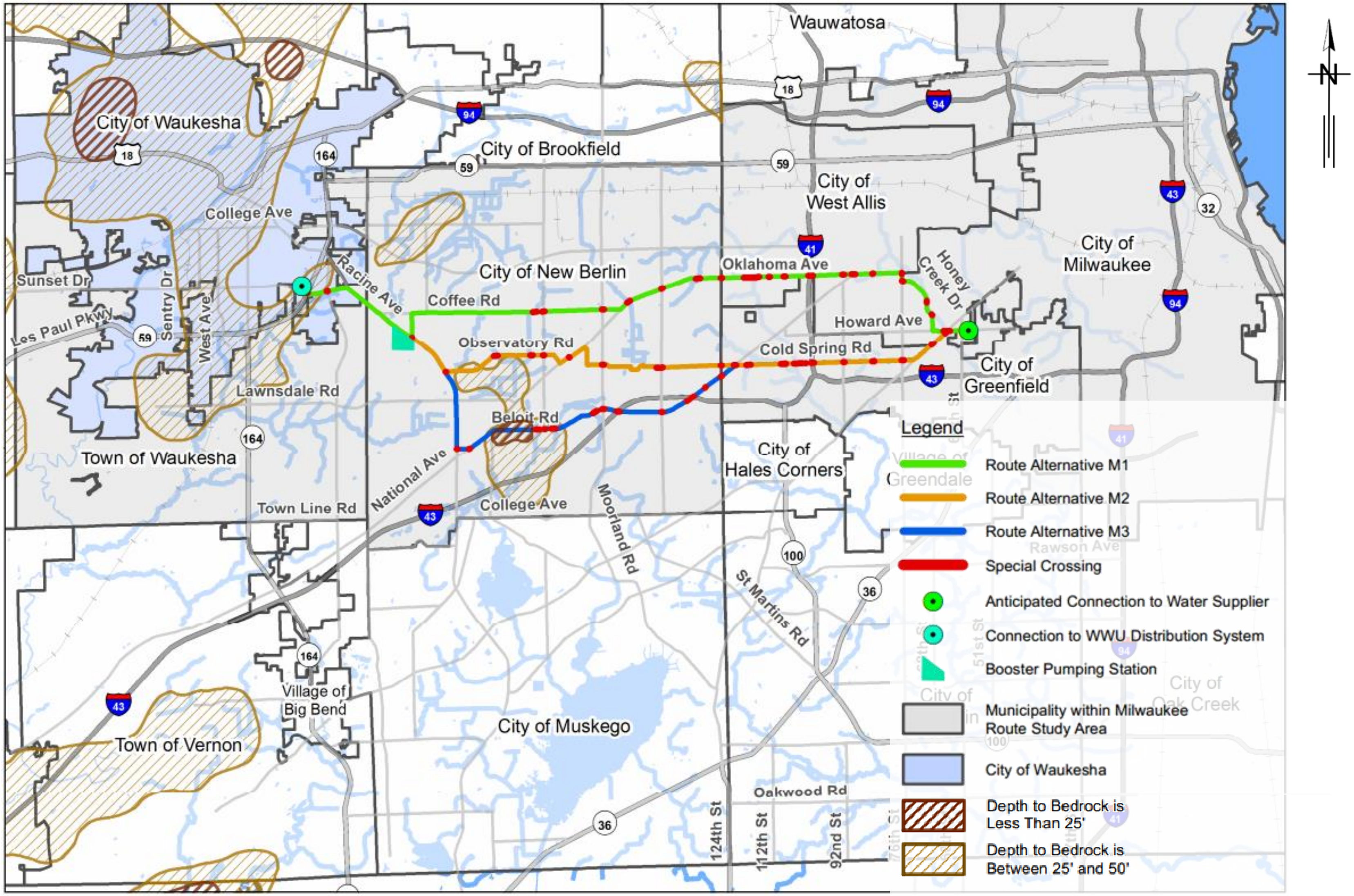
***Note:** Pipeline lengths for all route alternatives are based on the lengths between the anticipated connection point in Milwaukee near 60th Street and Howard Avenue, and the WWU distribution connection at Sunset Drive and Route 59.**

Longer pipeline length increases the potential for latent defects (e.g., future leaks) and requires additional pipeline appurtenances that must be maintained.

More special crossings are generally indicative of effects to scheduling, more aquatic resources impacts, more risk and more permitting, more cost.

Route Alternative M2 has a shorter length of pipeline and special crossings, while Route Alternative M3 has a longer length of pipeline and special crossings.

Non-Economic Analysis: Depth to Bedrock



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Non-Economic Analysis: Depth to Bedrock

Geotechnical Soil Analysis: Depth to Bedrock*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
<25 feet	0 LF	0 LF	3,800 LF
25-50 feet	5,000 LF	9,400 LF	17,800 LF
>50 feet	63,900 LF	57,600 LF	50,500 LF

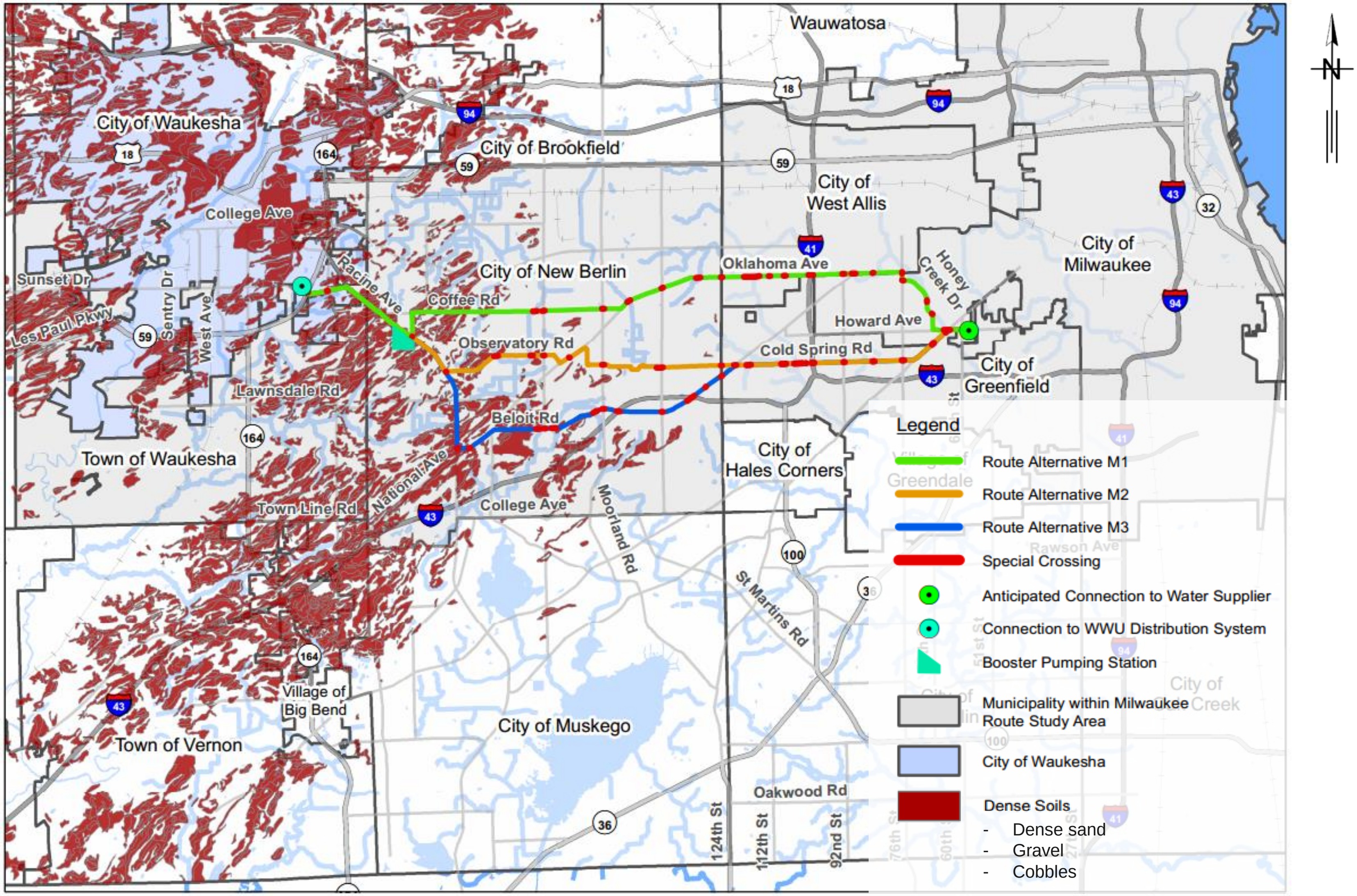
***Source - SEWRPC**

Shallow bedrock can increase cost and duration of construction.

Route Alternative M1 has less pipeline length through suspected shallow bedrock, while Route Alternative M3 has more pipeline length through suspected shallow bedrock.

Depths to bedrock will be confirmed with borings for the preferred route.

Non-Economic Analysis: Dense Soils



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Non-Economic Analysis: Dense Soils

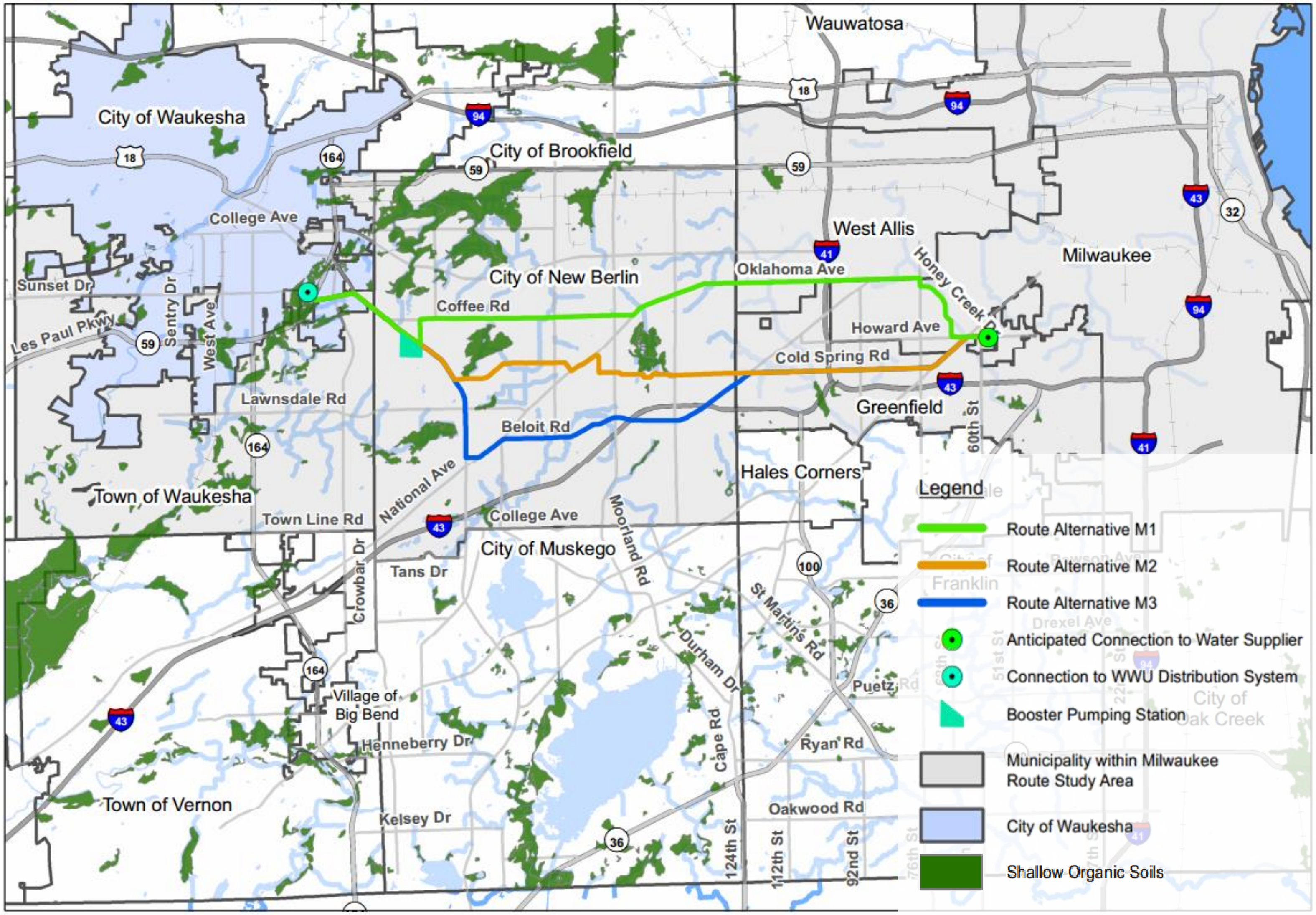
Geotechnical Soil Analysis: Dense Soils*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Length within Dense Soils	7,800 LF	10,600 LF	18,300 LF

***Source – USDA/NRCS, Bulk Density Testing**

Dense soils indicate the presence of gravel, cobbles, or dense sand. Dense soils lengths were developed utilizing the NRCS's Web Soil Survey online tool. More dense soils can impede construction, increasing cost and schedule.

Route Alternative M1 has less pipeline length through suspected dense soils, while Route Alternative M3 has more pipeline length through suspected dense soils.

Non-Economic Analysis: Organic Soils



Non-Economic Analysis: Organic Soils

Geotechnical Soil Analysis: Organic Soils*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Length within Organic Soils	400 LF	0 LF	0 LF

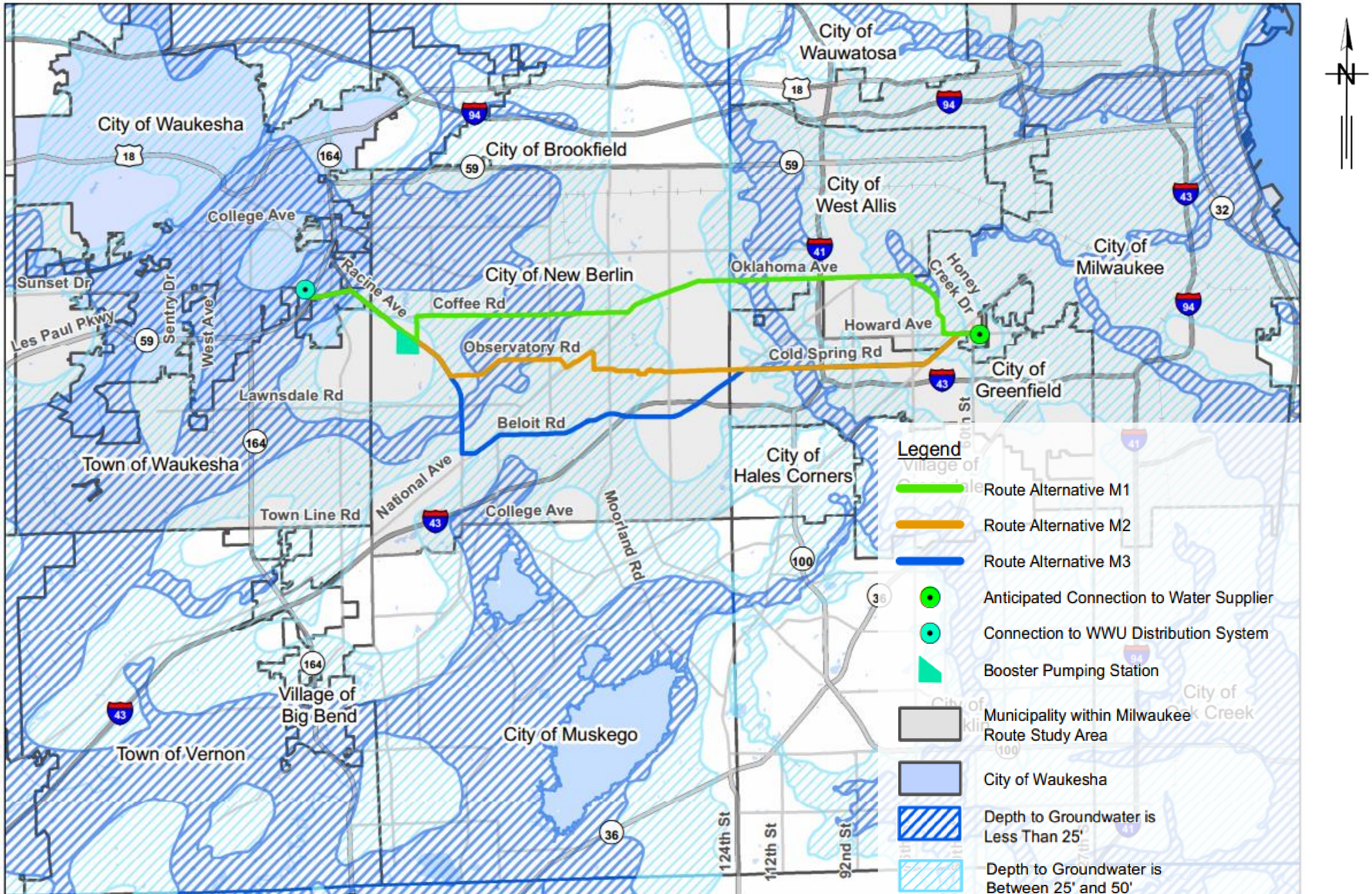
*Source – USDA/NRCS

The presence of organic soils may require over excavation and additional backfill materials that can impact cost and schedule.

Route Alternative M1's only segment through suspected organic soils is along Honey Creek Drive. This organic soil may have been removed and replaced during development.

Route alternatives are comparable in terms of suspected organic soils.

Non-Economic Analysis: Depth to Groundwater



Non-Economic Analysis: Depth to Groundwater

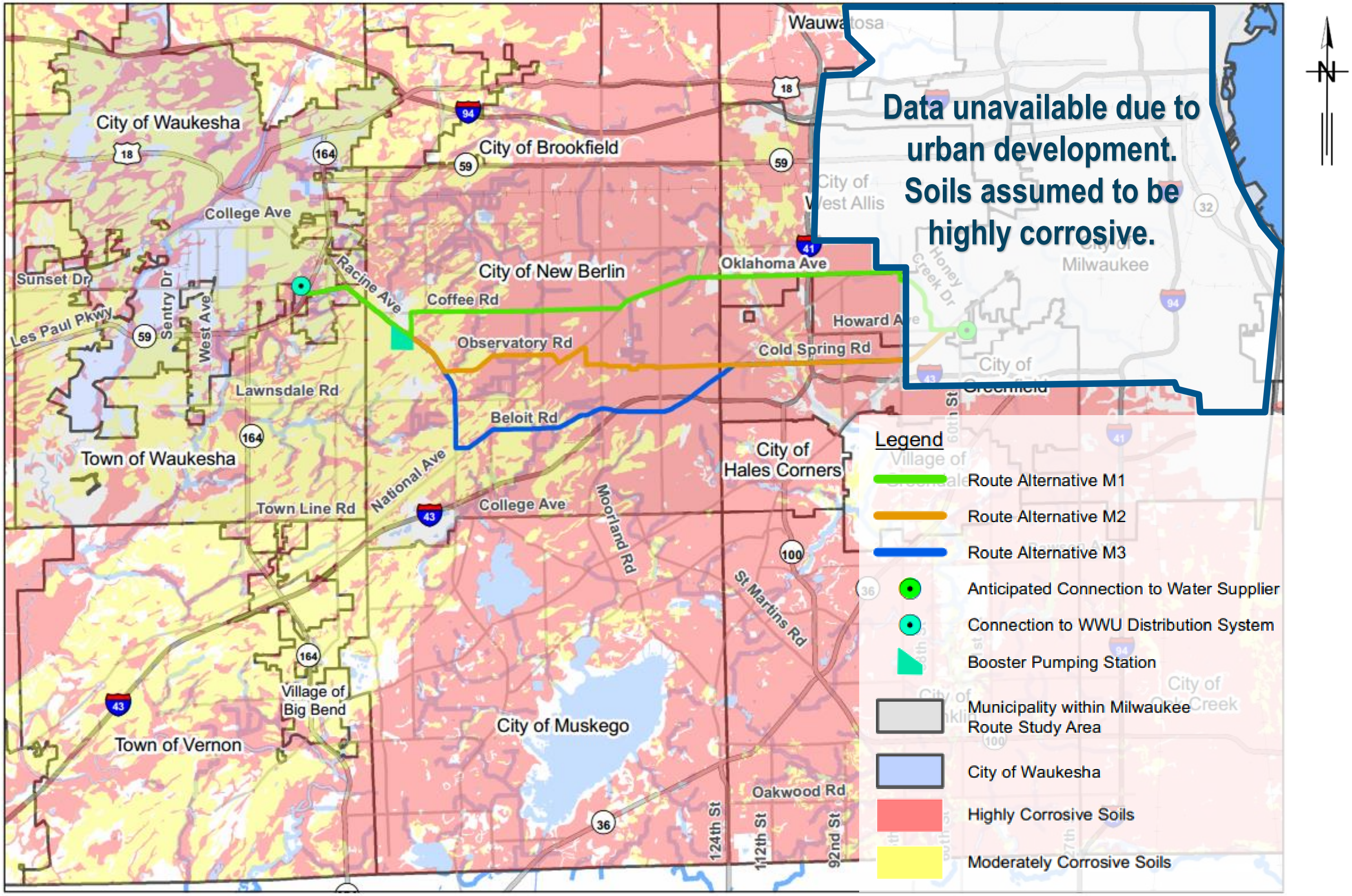
Geotechnical Soil Analysis: Depth to Groundwater*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Total Length over Shallow Groundwater (0-25 feet in depth)	30,600 LF	20,600 LF	15,200 LF

***Source – USDA/NRCS**

Shallow groundwater can increase the need for dewatering and the general complexity of open cut and trenchless construction via jack and bore method.

Route Alternative M1 has more pipeline length through areas of suspected shallow groundwater, while Route Alternative M3 has less pipeline length through areas of suspected shallow groundwater.

Non-Economic Analysis: Corrosive Soils



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Non-Economic Analysis: Corrosive Soils

Geotechnical Soil Analysis: Corrosive Soils*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Length within Soils Corrosive to Steel/Ductile Iron	40,700 LF	48,400 LF	44,700 LF

***Source – USDA/NRCS**

Corrosive soils can impact the level of corrosion protection required along the pipelines that can impact design and cost.

Route Alternative M1 has less pipeline length through areas of suspected corrosive soils, while Route Alternative M2 has more pipeline length through areas of suspected corrosive soils to ductile iron and steel pipe.

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Non-Economic Analysis: Contaminated Materials

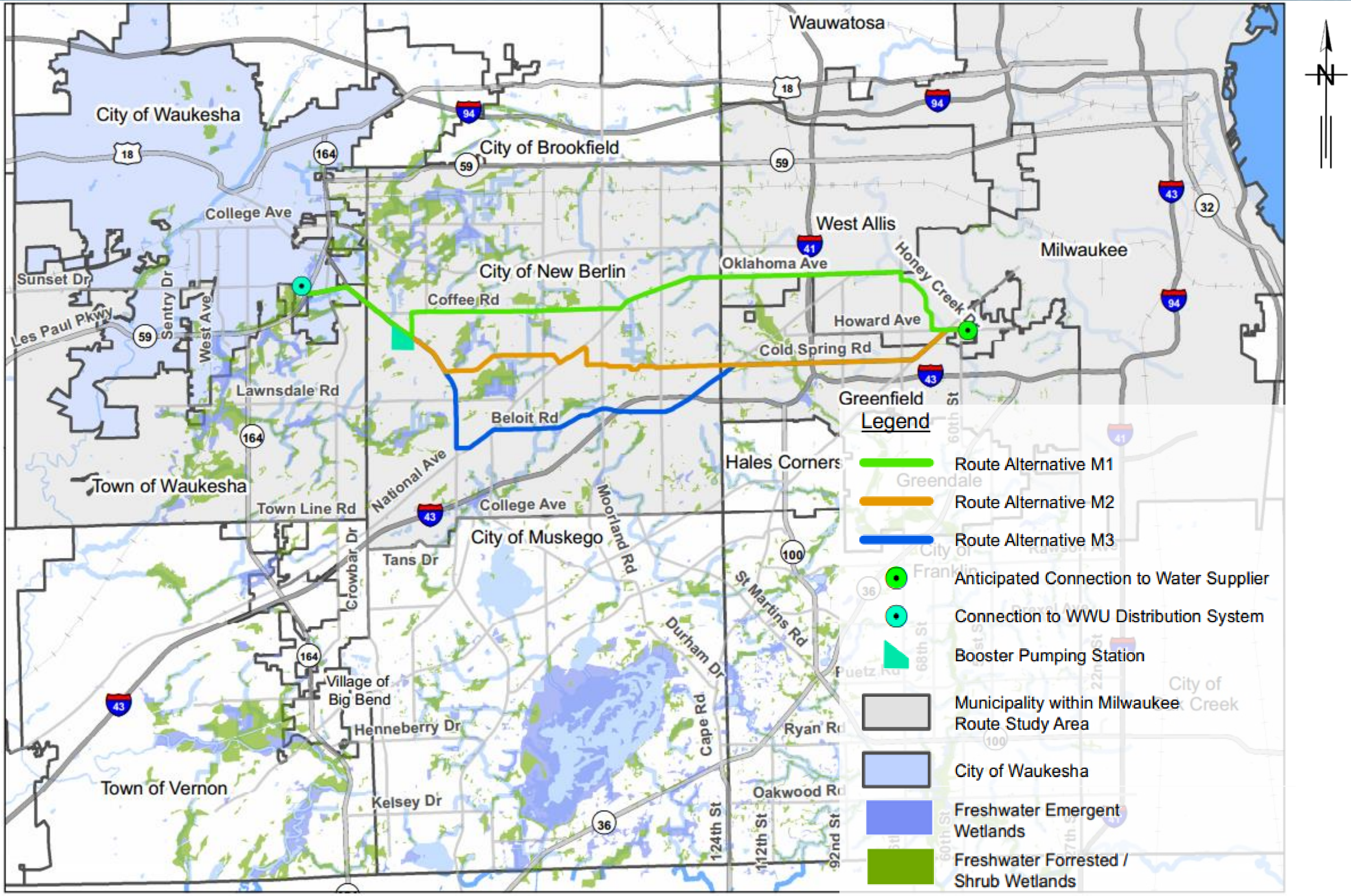
Contaminated Materials*			
Potential Impact Rank (1=Low Risk, 5=High Risk)	Route Alternatives		
	M1	M2	M3
	Number of Sites by Impact Rank		
1	39	31	41
2	20	15	14
3	8	8	8
4	11	4	6
5	8	3	4
Total Ranking Score on Route	**86**	**61**	**73**
Total Number of Sites Encountered on Route	**187**	**116**	**137**

*Sources – Environmental Risk Information Services, WDNR, Historical Documents

Contaminated materials can impact the cost and duration of construction by changing hauling and disposal requirements.

Route Alternative M2 is routed in proximity to fewer suspected contaminated material sites, while Route Alternative M1 is routed in proximity to more suspected contaminated material sites.

Non-Economic Analysis: Wetlands



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Non-Economic Analysis: Wetlands

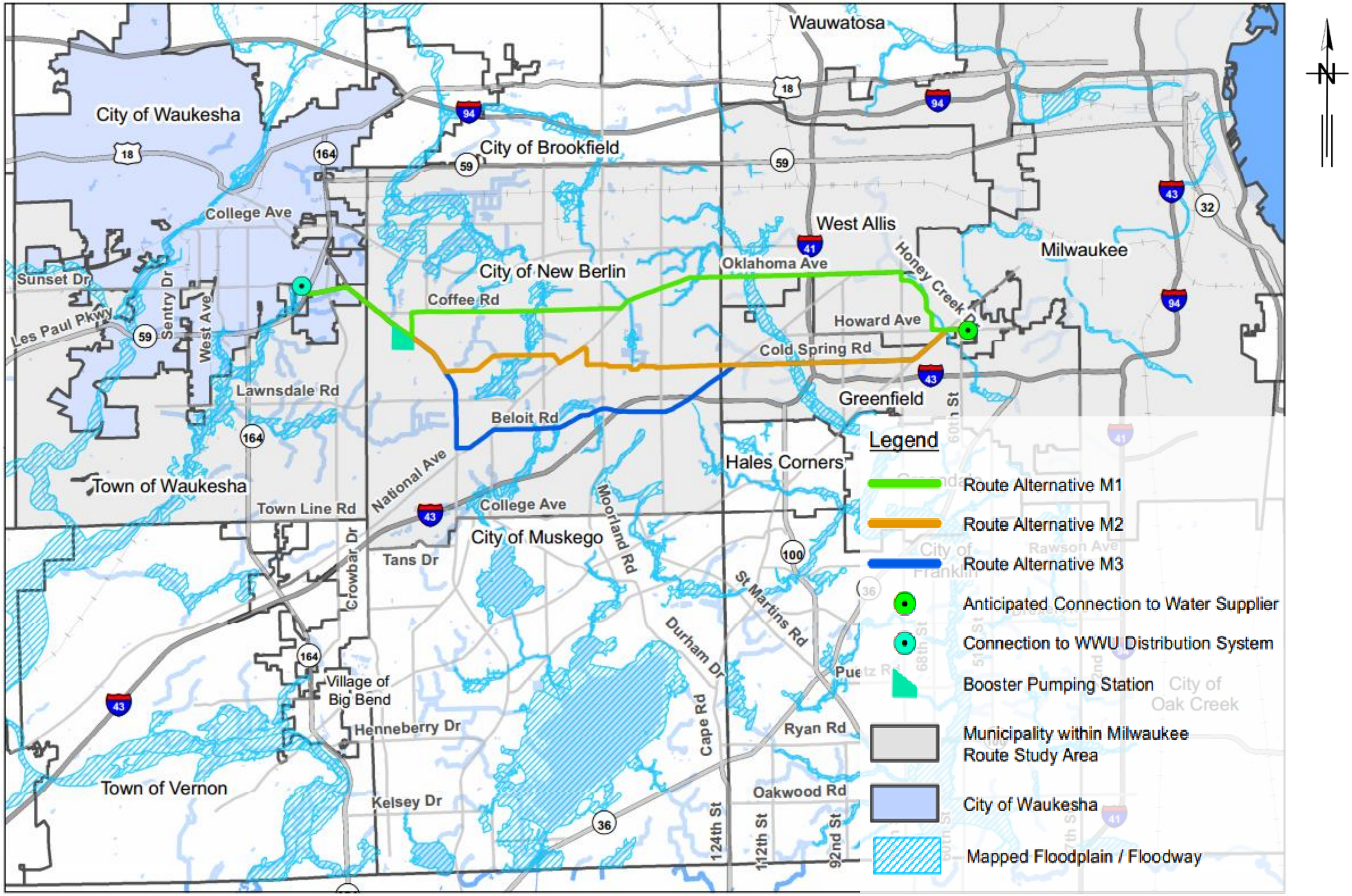
Mapped Wetland Impacts*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Total Number of Wetlands	41	73	113
Wetlands within Right-of-Way	2.8 ac	1.5 ac	3.1 ac
Wetlands within Easements	0	0	0
Total	2.8 ac	1.5 ac	3.1 ac

***Sources – Digital Wetland Inventory (From WDNR), the Wisconsin Wetland Inventory, & NRCS Soil Maps**

Wetland impacts can affect regulatory mitigation and schedule.

Route alternatives are comparable in terms of potential wetland impacts.

Non-Economic Analysis: Waterways



Non-Economic Analysis: Waterways

Potential Waterway Crossings*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Miles of Waterways within Right-of-way	0.19	0.14	0.16
Total Number of Waterway Crossings	8	8	8
Named Waterway Crossings	**1**	**1**	**1**
Unnamed Waterway Crossings	7	7	7

***Sources – WDNR & USGS Topographic Maps**

Waterways can impact the length of HDD segments of the pipelines required, cost, and permitting effort.

Route alternatives are comparable in terms of waterways.

Non-Economic Analysis: Endangered Resources

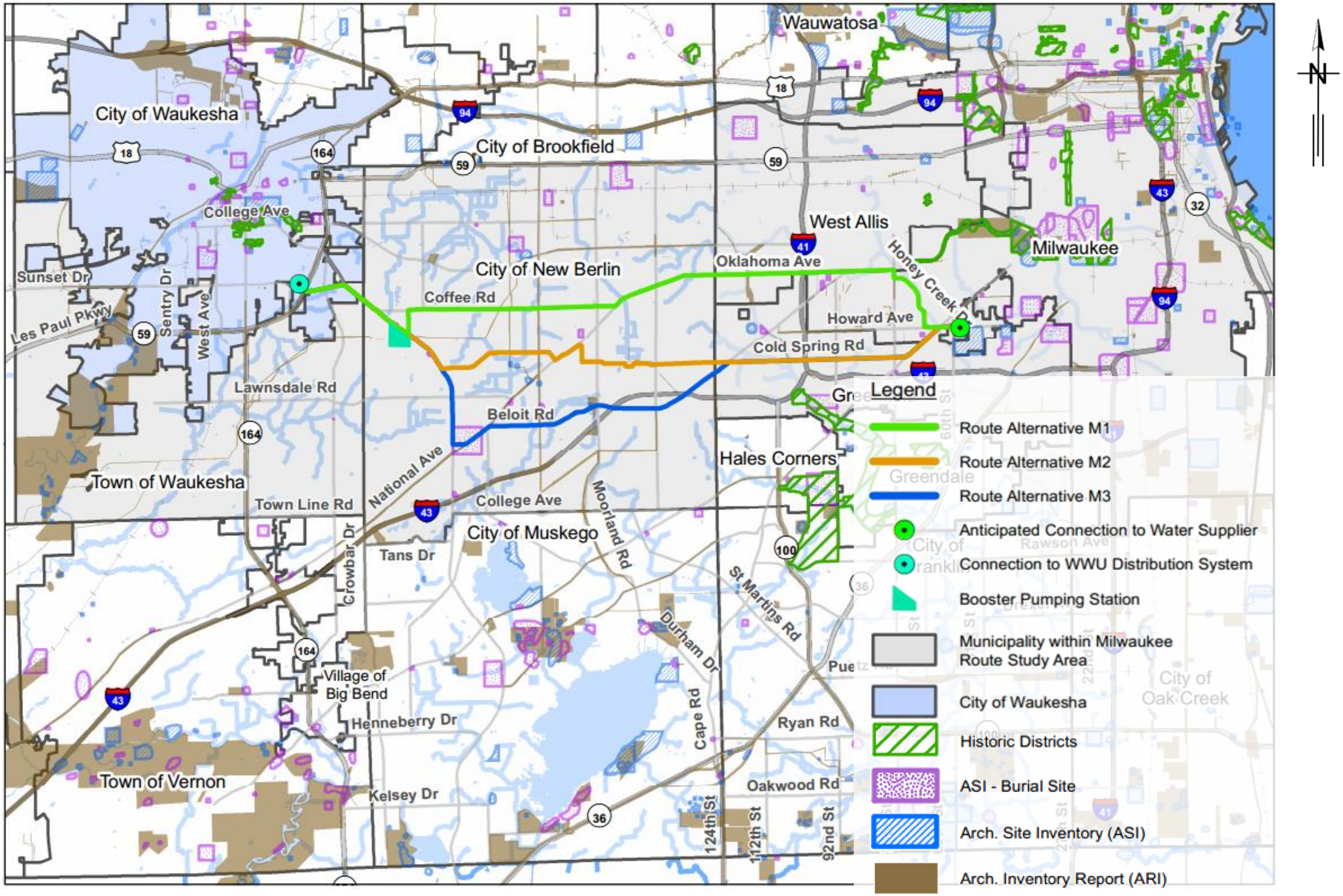
Endangered Resources*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Resources with Required Measures	0	0	0
Resources with Recommended Measures	4	5	4
Resources with No Impact	8	3	3
Federal Rare, Threatened, and Endangered Species	6	6	6
USFWS Bumble Bee Low Potential Zone	2	2	2
USFWS Bumble Bee High Potential Zone	0	0	0

***Sources – WDNR Natural Heritage Inventory, USFWS Information Planning and Consultation data**

Endangered resources can affect the length of construction and permitting effort. Fewer endangered resources are generally indicative of less risk of schedule delays and less permitting. Recommended measures for endangered resources include time of year restrictions, exclusion fencing, and erosion control

Route Alternatives M1 and M3 are comparable and are in proximity to fewer suspected endangered resources, while Route Alternative M2 is in proximity to more suspected endangered resources.

Non-Economic Analysis: Cultural Resources



Non-Economic Analysis: Cultural Resources

Cultural Resources*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Archaeological Sites	0	0	1
Burial Sites	1	2	3
Historic Structures	0	0	1
NRHP Listed	0	0	0

***Source – Wisconsin Historical Society**

Cultural resources will require Phase I survey to comply with the National Historic Preservation Act.

Route Alternative M3 is routed in proximity to additional archaeological sites, burial sites, and historic structures, while Route Alternative M1 is routed in proximity to fewer cultural resources sites.

Non-Economic Analysis: Agricultural Lands

Agricultural Lands*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Certified Organic Farms	0	0	0
Easements Agricultural Land (ac.)	0	0	0

***Sources – Waukesha County Open Data Portal Website, Milwaukee County Land Information Office Geospatial data, USDA Organic Integrity Database, & the Organic Agriculture in Wisconsin 2017 & 2015 Status Reports**

Agricultural impacts can increase the regulatory and permitting effort with the PSC and WDNR, especially when considering organic farms.

Route alternatives are comparable in terms of agricultural lands.

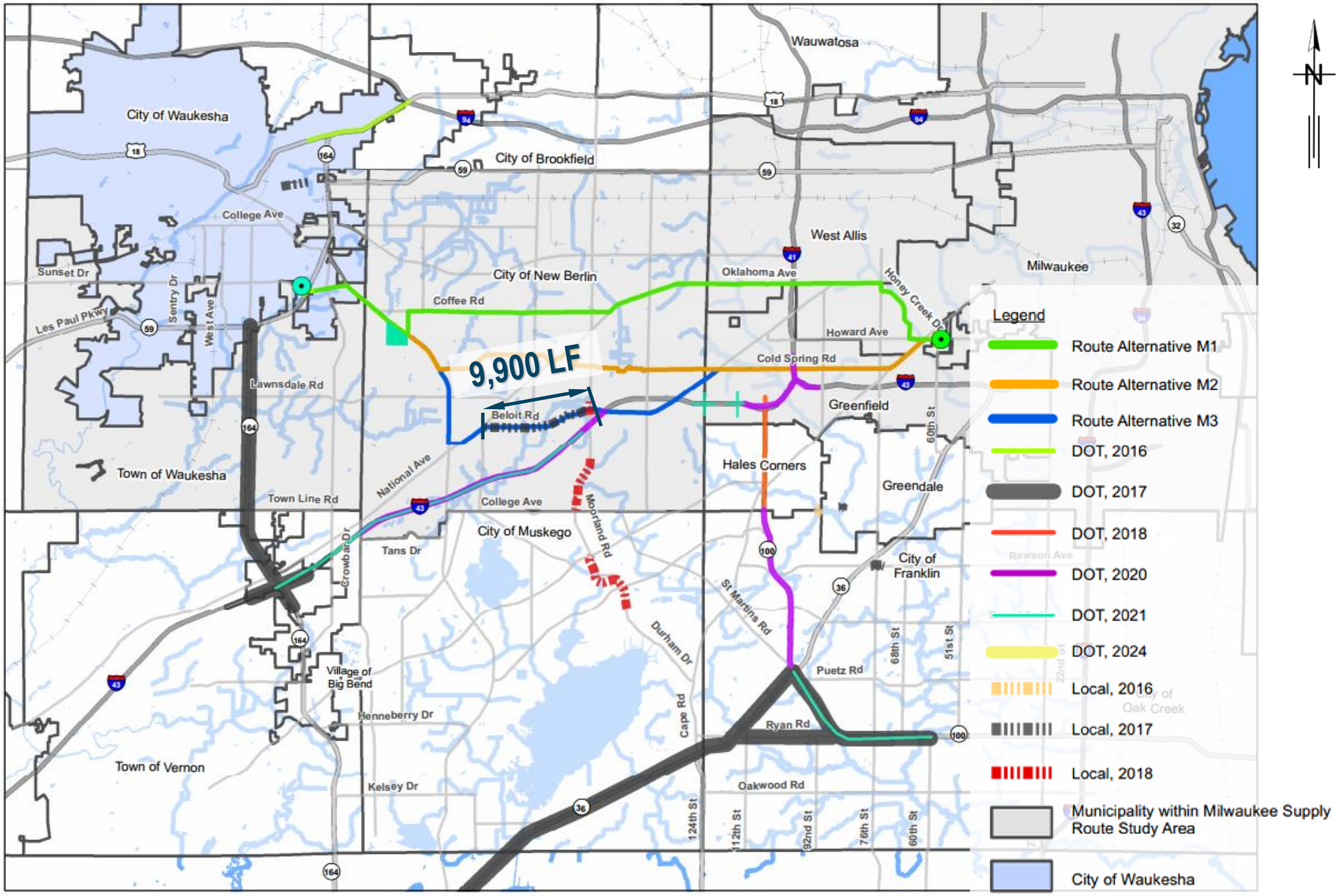
Non-Economic Analysis: Transportation

Transportation				
	Route Alternatives			
Evaluation Item	Common	M1	M2	M3
Total Roadway Length	2.5 mi	10.5 mi	10.1 mi	11.3 mi
Total Roadway Pavement Area	24,000 sf	527,000 sf	453,000 sf	394,000 sf
Total Additional Travel Distance from Detours	0 mi	122,000 mi	317,000 mi	1,759,000 mi
Total Lost Travel Time from Detours	0 hrs	5,700 hrs	57,900 hrs	76,400 hrs

Transportation affects maintenance of traffic requirements, ease of construction, cost, and public acceptability.

Route Alternative M1 is anticipated to have less travel detour distance and detour hours, while Route Alternatives M2 and M3 are anticipated to have more travel detour distance and detour hours.

Non-Economic Analysis: Planned Regional Transportation Projects



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Non-Economic Analysis: Planned Regional Transportation Projects

Recent or Planned Regional Transportation Projects – Length Along Route Alternatives (LF)			
Anticipated Year of Construction	Route Alternatives		
	M1	M2	M3
2017	0	0	9,900
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0	0
Total	**0**	**0**	**9,900 LF**

Recent or planned regional transportation projects that overlap routes anticipated before construction can affect design, schedule, cost, and permitting. Where regional transportation projects are planned during Program construction, opportunities exist to take advantage of potential synergies, such as sharing maintenance of traffic and surface restoration costs between the two projects.

Route Alternative M3 is routed along more recently completed or planned regional transportation projects than Route Alternatives M1 and M2.

Non-Economic Analysis: Energy Consumption

Energy Consumption			
	Route Alternatives		
Items	M1	M2	M3
WSPS Total Head (ft)	430	430	450
BPS Total Head (ft)	150	150	150
Total Head Required (ft)	**580**	**580**	**600**

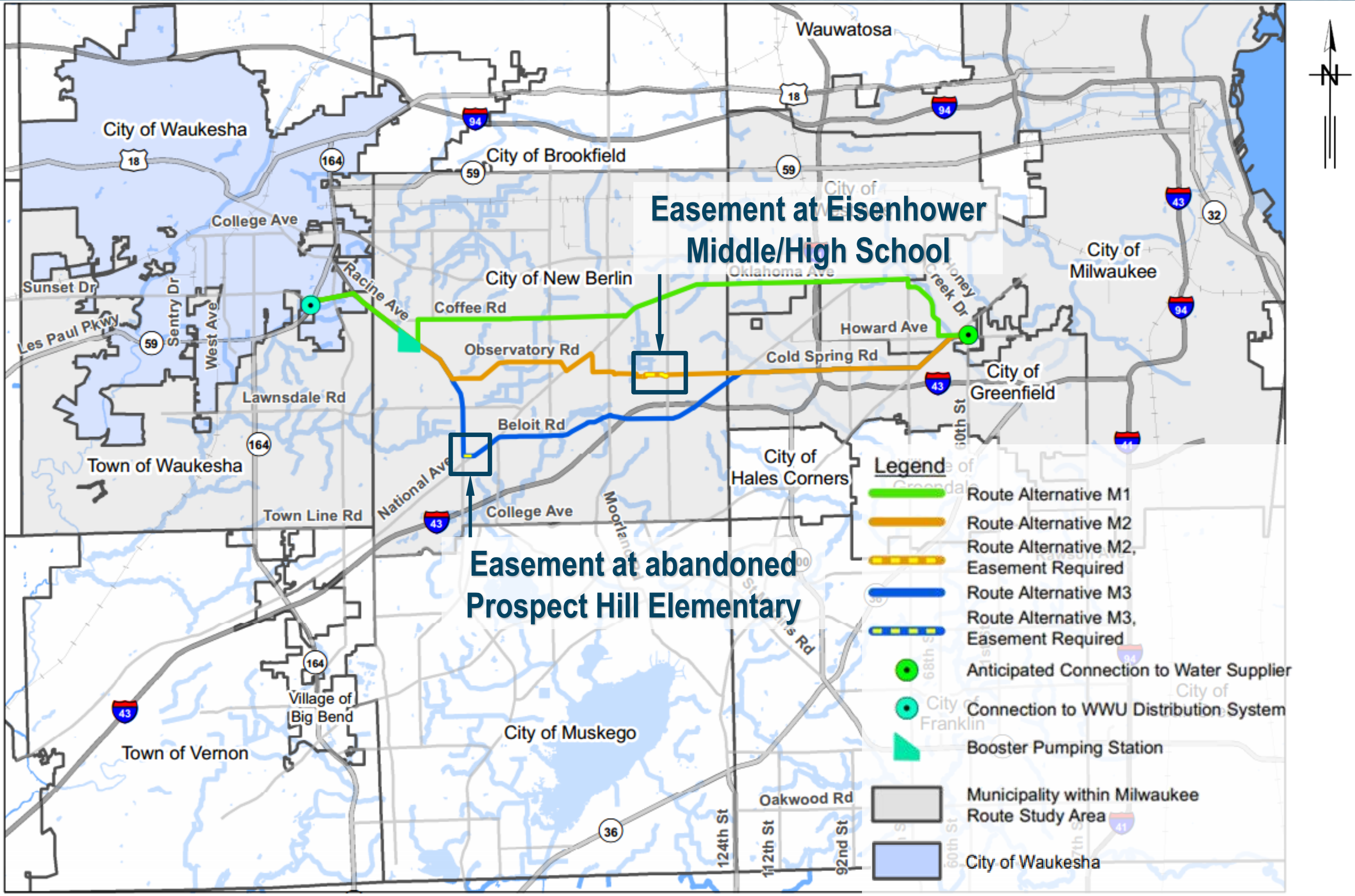
Energy consumption impacts operational costs.

Route Alternative M3 has a longer pipeline length, which increases head loss and energy consumption. Route Alternatives M1 and M2 are comparable and are anticipated to consume less energy.

Non-Economic Analysis: Stakeholder Feedback

For discussion…

Non-Economic Analysis:
Real Property and Easement Requirements



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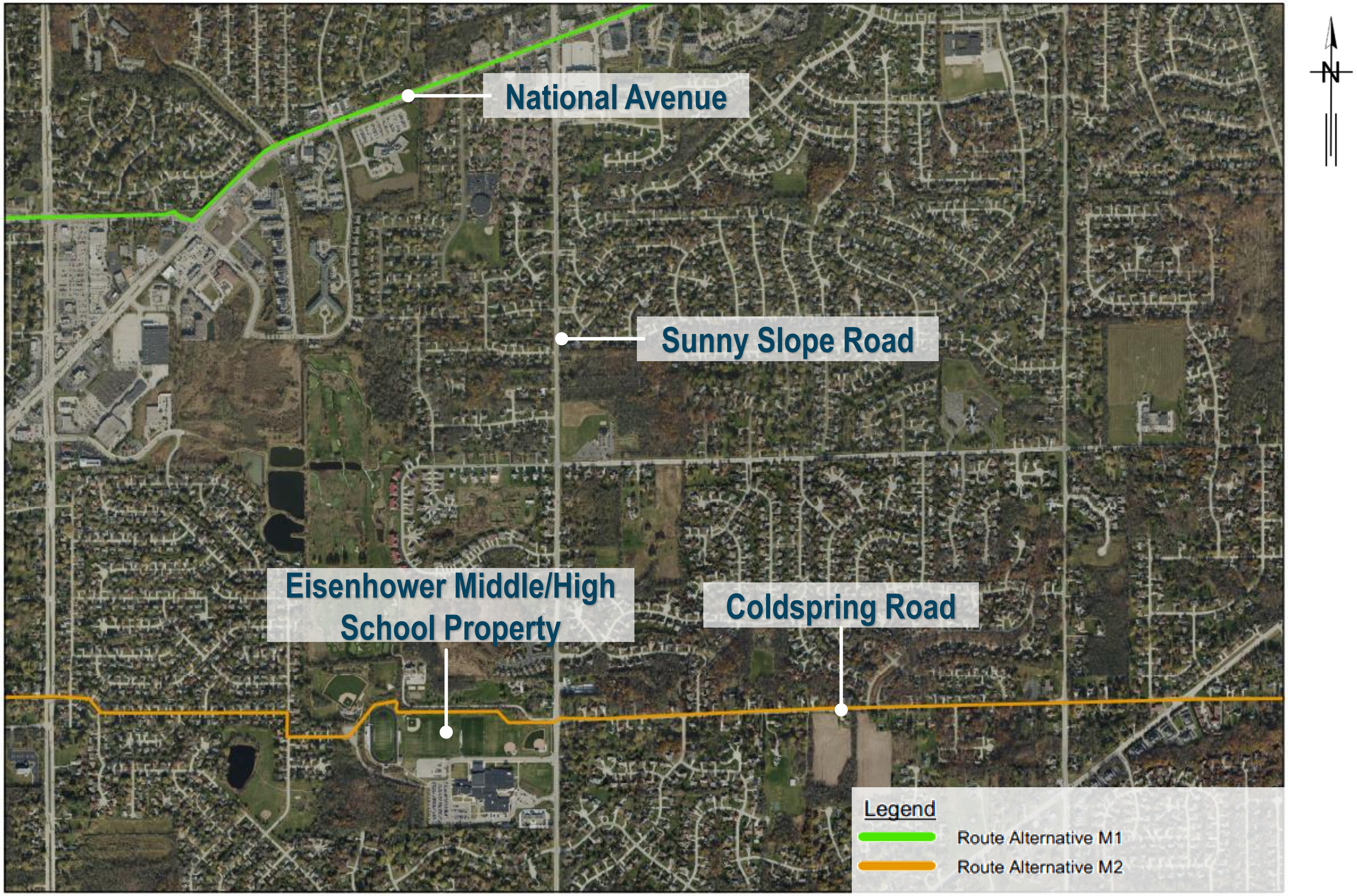
Non-Economic Analysis: Real Property and Easement Requirements

Real Property and Easement Requirements			
Items	Route Alternatives		
	M1	M2	M3
Number of Easements	0	1	1
Acreage of Easements	0	2.9 ac	1.1 ac

More easements can increase costs and pose risks to additional pipeline length and schedule delays if the property owner is not amenable to the easement.

Route Alternative M1 requires no easements. Route Alternative M2 requires the most acreage through easements and could also require a construction phasing restriction. Although there is an easement on Route Alternative M3, the property is abandoned and could potentially be used as a construction lay-down area.

Non-Economic Analysis: Real Property and Easement Requirements



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Non-Economic Analysis: Comparison

Non-Economic Analysis			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils	Comparable		
Depth to Groundwater	More	Fair	Less
Corrosive Soils	Less	More	Fair
Contaminated Materials	More	Less	Fair
Wetlands	Comparable		
Waterways	Comparable		
Endangered Resources	Less	More	Less
Cultural Resources	Less	Fair	More
Agricultural Resources	Comparable		
Transportation (i.e., Maintenance of Traffic)	Less	More	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges	For discussion		
Real Property and Easement Requirements	Less	More	Fair

Route Alternative M3 is less preferable due to:

- **Increased pipeline length**
- **Increased special crossing length**
- **Potential increased occurrence of shallow bedrock and dense soils**
- **Additional risks to cultural resources impacts**
- **Additional maintenance of traffic requirements**
- **Additional conflicts with recently completed or planned regional transportation projects**
- **Additional energy consumption**

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Non-Economic Analysis: Comparison

Non-Economic Analysis			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils		Comparable	
Depth to Groundwater	**More**	Fair	Less
Corrosive Soils	Less	**More**	Fair
Contaminated Materials	**More**	Less	Fair
Wetlands		Comparable	
Waterways		Comparable	
Endangered Resources	Less	**More**	Less
Cultural Resources	Less	Fair	More
Agricultural Resources		Comparable	
Transportation (i.e., Maintenance of Traffic)	Less	**More**	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges		For discussion	
Real Property and Easement Requirements	Less	**More**	Fair

Route Alternative M2 is less preferable with respect to Route Alternative M1 due to:

- **Additional length through suspected areas of corrosive soils**
- **Additional maintenance of traffic requirements**
- **Potential for additional stakeholder challenges**
- **Additional easement requirements that also pose a risk to longer pipeline length and schedule impacts**
- **Additional construction challenges through narrow corridors**

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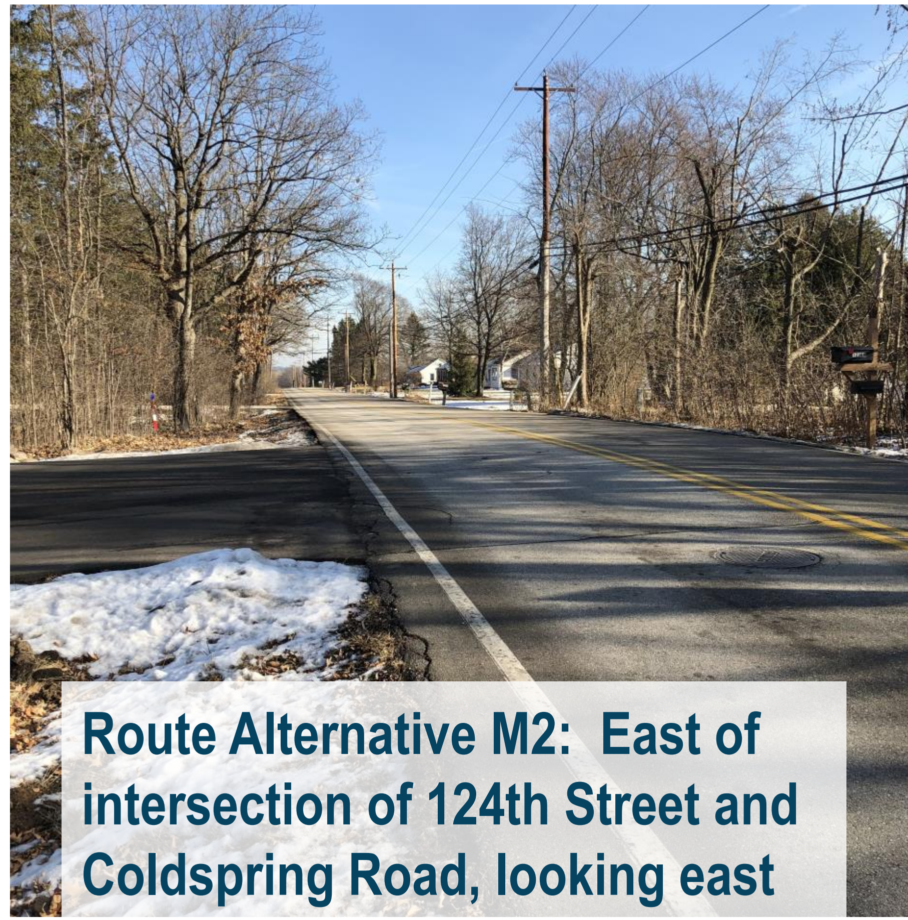
Non-Economic Analysis: Comparison

Route Alternative M2: West of intersection of 124th Street and Coldspring Road, looking west

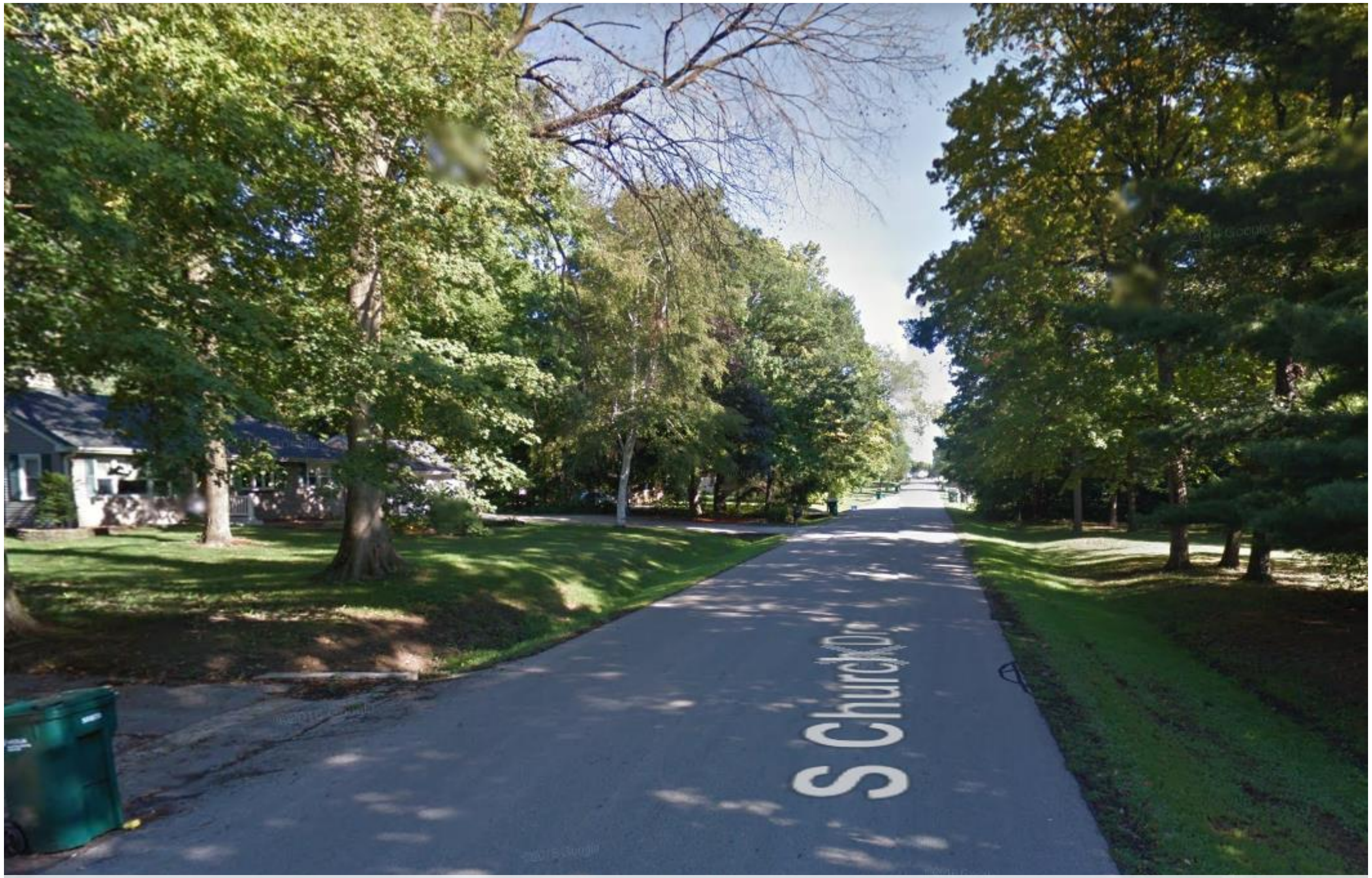


Route Alternative M2: East of intersection of 124th Street and Coldspring Road, looking east

Non-Economic Analysis: Comparison

Route Alternative M2: Intersection of Katherine Drive and Mayflower Drive, looking west (neighborhood west of Eisenhower middle/high school)

Non-Economic Analysis: Comparison



Route Alternative M2: Intersection of Church Drive and Mayflower Drive, looking north (neighborhood west of Eisenhower middle/high school)

Non-Economic Analysis: Comparison

Non-Economic Analysis			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils		Comparable	
Depth to Groundwater	More	Fair	Less
Corrosive Soils	Less	More	Fair
Contaminated Materials	More	Less	Fair
Wetlands		Comparable	
Waterways		Comparable	
Endangered Resources	Less	More	Less
Cultural Resources	Less	Fair	More
Agricultural Resources		Comparable	
Transportation (i.e., Maintenance of Traffic)	Less	More	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges		For discussion	
Real Property and Easement Requirements	Less	More	Fair

Route Alternative M1 is preferred on a non-economic basis.

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Non-Economic Analysis: Comparison

Route Alternative M1: Intersection of 100th Street and Oklahoma Avenue, looking east

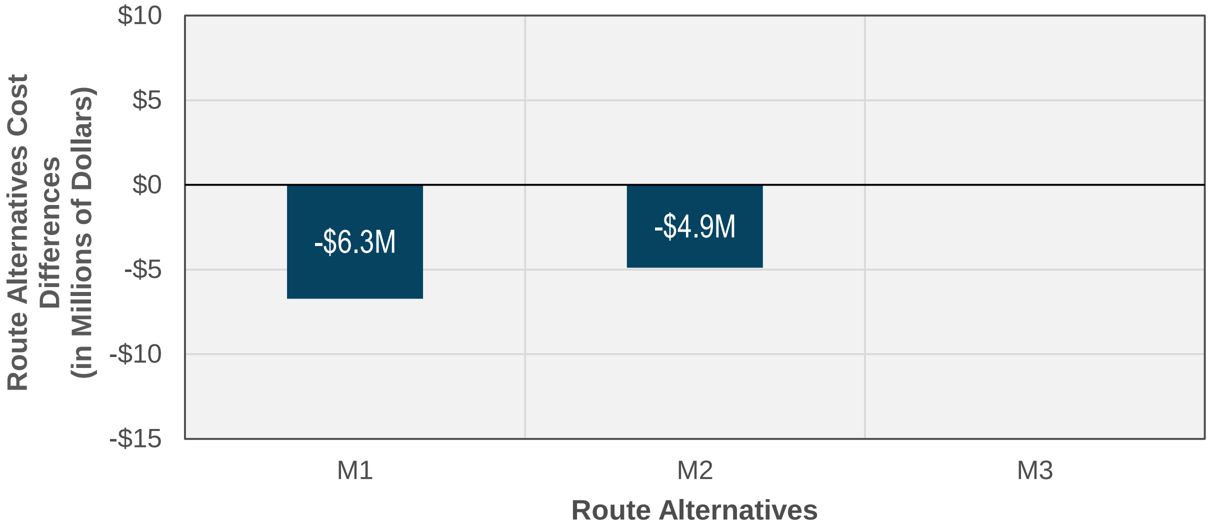
Non-Economic Analysis: Comparison

Route Alternative M1: Intersection of Calhoun Road and Coffee Road, looking east

Economic Analysis

Economic Analysis: Program Costs

Program Cost ($M, June 2017 ENR CCI = 10,942)			
	Route Alternatives		
Cost Item	M1	M2	M3
Program Cost Difference ($M)	-6.3	-4.9	0.0



Route Alternatives M1 and M2 are less costly than Route Alternative M3. Route Alternative M1 is least costly.

Route Alternative M2 has risks of increased cost due to:

- **Increased pipeline length (estimated an additional $3.1M in Program Costs to avoid Eisenhower School easement by utilizing Sunny Slope Road to Oklahoma Avenue)**
- **Additional surface restoration and utility relocation**

Route Scoring

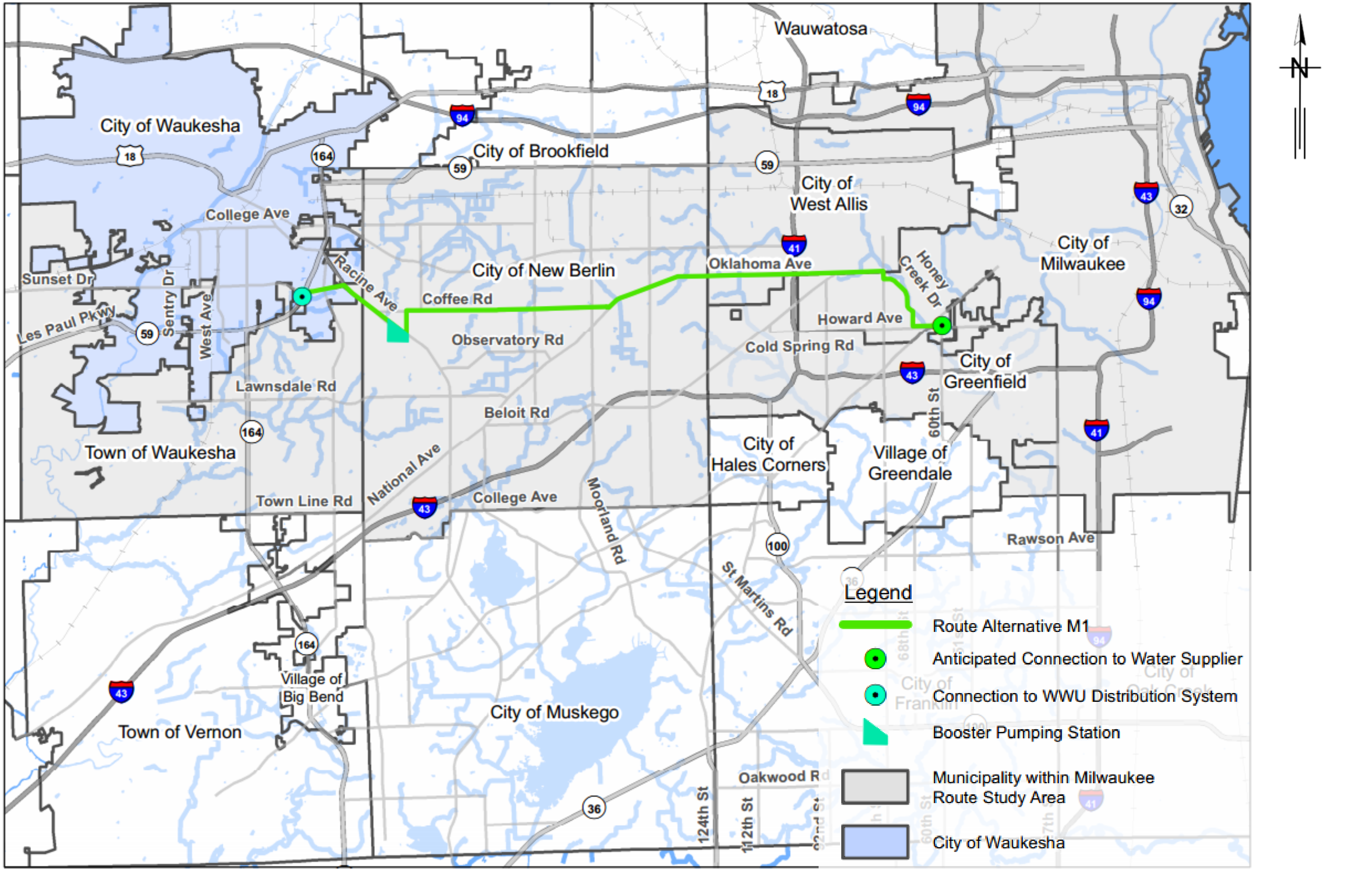
Route Scoring: Key Performance Indicator Metrics

Key Performance Indicator	Metrics
Capital Cost	Capital Cost (U.S Dollars)
Schedule	Days (Determined by Linear Feet of Pipe / Day)
Operations	Number of Pressure Release Valves, Number of Connections to the Distribution System, Distribution System Pressure (psi)
Future Expansion	Number of Municipalities Traversed, Average Daily Demand of Municipalities Traversed (MGD)
Environmental Impact	Acreage of WWI Mapped and Photo-Interpreted Wetlands, Number of Waterways Crossed, Endangered Species
Public Acceptability	Protected Resources (# of Archaeological, Burial, and Historic Sites), Transportation (Linear Feet of Roadway Impacts, Square Footage of Pavement Area, Additional Driving Hours), Number of Easements, Agriculture (Acreage in the 50-ft buffer, Acreage in the Easements), Coordination with Planned Construction
System Reliability	Length of Pipe (LF), Accessibility (Number of Special Crossings, Number of Easements), Max Pressure (psi)
Ease of Construction	Depth to Bedrock (LF of Pipe < 50ft deep), Dense Soils (LF of Pipe), Organic Soils (LF of Pipe), Depth to Groundwater (LF of Pipe < 6ft deep), Soils Corrosive to Steel/Ductile Iron (LF of Pipe), Soils Corrosive to PCCP (LF of Pipe), Contaminated Materials (Total Ranking Score on each Route)
Life Cycle Cost	Capital Cost (U.S. Dollars), Energy Cost (U.S. Dollars)
Cost Sharing Potential	Number of Municipalities Traversed, Simultaneous Planned Construction Projects
Effects on Ability to Finance	Envision Score

Route Scoring: Triple Bottom Line Analysis

	Criteria	Actual Weights	Maximum Possible Score	Route Alternatives		
				M1	M2	M3
1	***Social and Community Goals***					
1.1	*Schedule*	*14.0*	*5*	3	2	2
1.2	*Public Acceptability*	*6.5*	*5*	5	2	3
1.3	*Operations*	*6.0*	*5*	3	3	3
1.4	*Future Connections*	*6.0*	*5*	3	3	4
2	***Economic Goals***					
2.1	*System Reliability*	*19.0*	*5*	3	3	3
2.2	*Life Cycle Cost*	*15.5*	*5*	3	3	3
2.3	*Ease of Construction*	*11.0*	*5*	4	2	3
2.4	*Capital Cost*	*6.0*	*5*	3	3	2
2.5	*Ability to Finance*	*6.0*	*5*	4	2	3
2.6	*Cost Sharing Potential*	*5.0*	*5*	3	3	4
3	***Environmental Goals***					
3.1	*Environmental Impact*	*5.0*	*5*	3	3	3
	Net TBL Score	**100**	**500**	**330**	**263**	**291**
	Percent of Max Possible Score		NA	**66%**	**53%**	**58%**

Route Scoring: Preliminary Preferred Water Supply Route



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Summary Wrap-Up and Action Items

Summary Wrap-Up and Action Items

- Reviewed Non-Economic Analysis for Route Alternatives
- Reviewed Economic Analysis for Route Alternatives
- Presented Route Scores and Gained Consensus on the Preliminary Preferred Route

THANK YOU

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MEETING SUMMARY

The Great Water Alliance (Program) Route Study Meeting on the preferred route for the Water Supply Pipeline was held in the Waukesha Water Utility (WWU) Large Conference Room at 9:30 a.m. on April 6, 2018. The purpose of the meeting was to summarize the route study and identify the preferred route for the Water Supply Pipeline. The attendees are listed on the attached sign-in sheet. The agenda and presentation materials are attached.

	Action Item	Action By	Due Date
1.	Proceed with completing the Draft Route Study: Milwaukee (DEL 4-100 D2), identifying Route Alternative M1 as the preferred route.	T. Bluver	**4/13/18**

1) **Welcome**
   a) The agenda, meeting objectives, and key work recently performed were discussed.
   b) Route alternatives were evaluated with the Water Supply Pumping Station (WSPS) and connection point to the Milwaukee Water Works (MWW) distribution system at 60th Street and Howard Avenue. The locations are not a differentiating factor in identifying the preferred route.

2) **Non-Economic Analysis**
   a) Route alternatives were evaluated based on non-economic criteria.
   b) Four Open House Meetings were held in the Cities of Greenfield, West Allis, New Berlin, and Milwaukee. Public comment received did not preclude use of any route alternative.
   c) Route Alternative M1 minimizes constructability challenges relative to the other route alternatives.
   d) Route Alternative M1 is preferred on a non-economic basis.

3) **Economic Analysis**
   a) Route alternatives were evaluated based on economic criteria.
   b) Route Alternative M1 has a lower Class 4 Opinion of Probable Construction Cost (OPCC) than the other route alternatives. Route Alternatives M2 and M3 have risks of higher OPCCs due the potential for additional surface restoration, suspected existing utilities through narrower corridors that would require the pipeline to be installed deeper, additional potential for utility relocation, and additional pipeline length if easements are not able to be acquired.

4) **Route Scoring**
   a) Route alternatives were scored based on findings from the non-economic and economic evaluations.
   b) Route Alternative M1 is more preferable than Route Alternatives M2 and M3.

5) **Summary Wrap-Up and Action Items**
   a) The WSPS is anticipated to be located at 68th Street and Morgan Avenue and the connection point to the MWW distribution system is anticipated to be located at 60th Street and Morgan Avenue. The locations serve to make Route Alternative M1 even more preferable by shortening Route Alternative M1 by 2,400 feet and lengthening the other route alternatives by 3,700 feet.

b) The Draft Route Study: Milwaukee (DEL 4-100 D2) will be submitted with the WSPS and connection to MWW's distribution system at 60th Street and Howard Avenue. The Draft Preliminary Design Report (DEL 6-240 D1) will include the WSPS at 68th Street and Morgan Avenue and the connection point to the MWW distribution system at 60th Street and Morgan Avenue.
c) Key action items are summarized in the table on Page 1 of this Summary.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER ALLIANCE

ROUTE STUDY MEETING: PREFERRED WATER SUPPLY ROUTE
SIGN-IN SHEET

April 6, 2018

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Chris Walter	Waukesha Water Utility	[redacted]
3	Kelly Zylstra	Waukesha Water Utility	[redacted]
4	Ted Bluver	Greeley and Hansen	[redacted]
5	Katie Richardson	Greeley and Hansen	[redacted]
6			
7			
8			
9			
10			
11			
12			

Date/Time: April 6, 2018, 9:30 a.m. – 10:00 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Chris Walter, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Katie Richardson, GH

Time	Topic	Presenter(s)
9:30 a.m.	Welcome - Agenda Overview (Handout) - Meeting Objectives - Key Work Recently Performed	Katie Richardson; Ted Bluver
9:35 a.m.	Non-Economic Analysis	Ted Bluver
9:45 a.m.	Economic Analysis	Ted Bluver
9:50 a.m.	Route Scoring - Key Performance Indicator Metrics - Triple Bottom Line Analysis - Preferred Water Supply Route	Katie Richardson
9:55 a.m.	Summary Wrap-Up and Action Items	Ted Bluver
10:00 a.m.	Adjourn	

Great Lakes Water Supply Program

Great Water Alliance | Task 4-100 Meeting No. 6

Route Study Meeting: Preferred Water Supply Route

April 6, 2018

GREAT WATER ALLIANCE™

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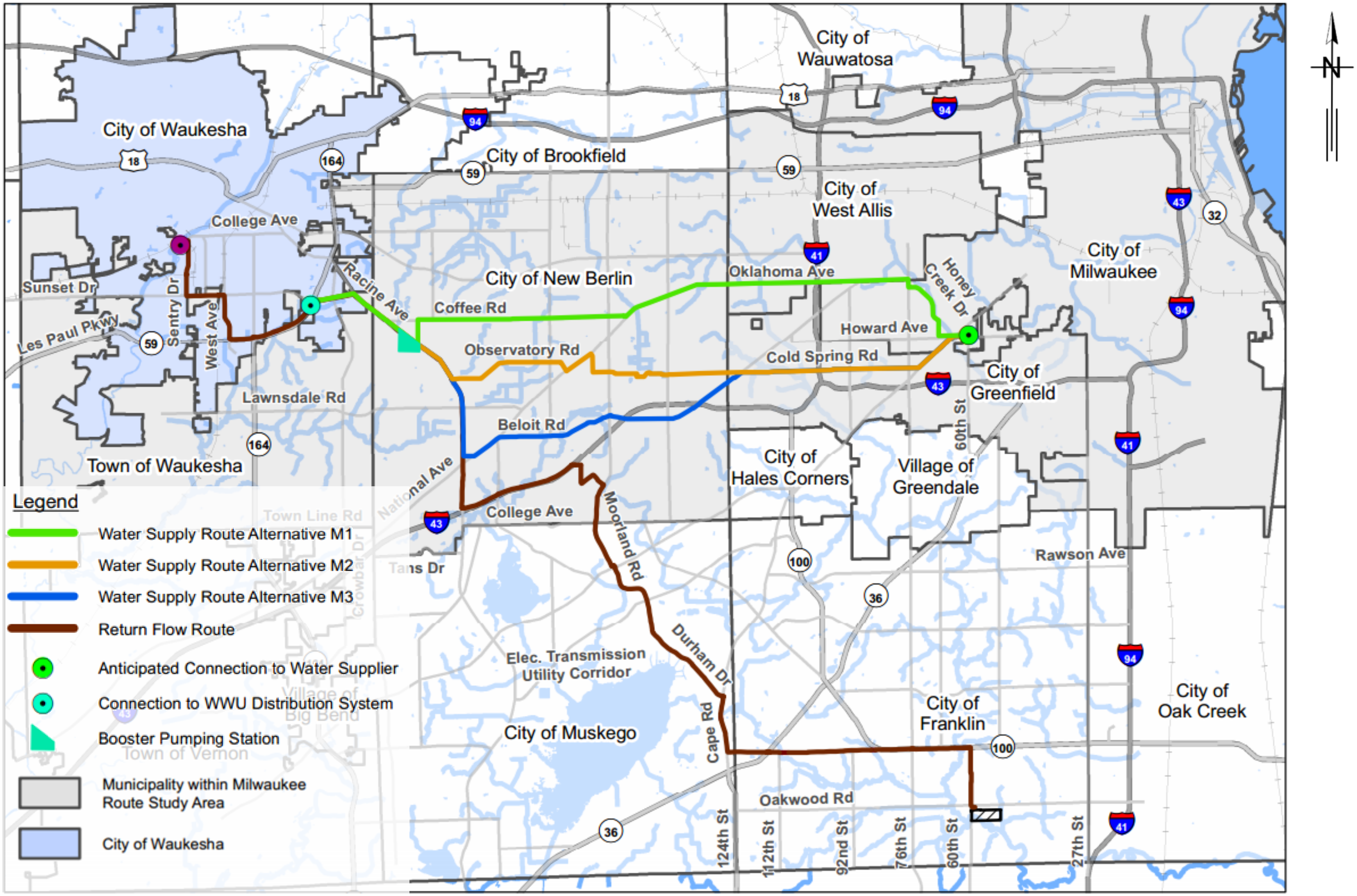
Meeting Objectives

- Review Non-Economic Analysis for Route Alternatives
- Review Economic Analysis for Route Alternatives
- Present Route Scores and Gain Consensus on the Preferred Water Supply Route

Key Work Recently Performed



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Key Work Recently Performed

- Submitted Oak Creek Route Study
- Compared Route Alternatives Based on Non-Economic Analysis
- Compared Route Alternatives Based on Economic Analysis
- Scored Route Alternatives and Identified the Preferred Water Supply Route
- Further Developed the Milwaukee Route Study and Preliminary Design Report

Non-Economic Analysis

Non-Economic Analysis:
Pipeline Lengths and Special Crossings

Pipeline Lengths and Special Crossings			
	Route Alternatives		
Evaluation Item	M1	M2	M3
*Total Pipeline Length	68,900 LF	67,000 LF	72,100 LF
Number of Special Crossings	23	22	24
Total Special Crossings Length	5,900 LF	5,200 LF	6,400 LF

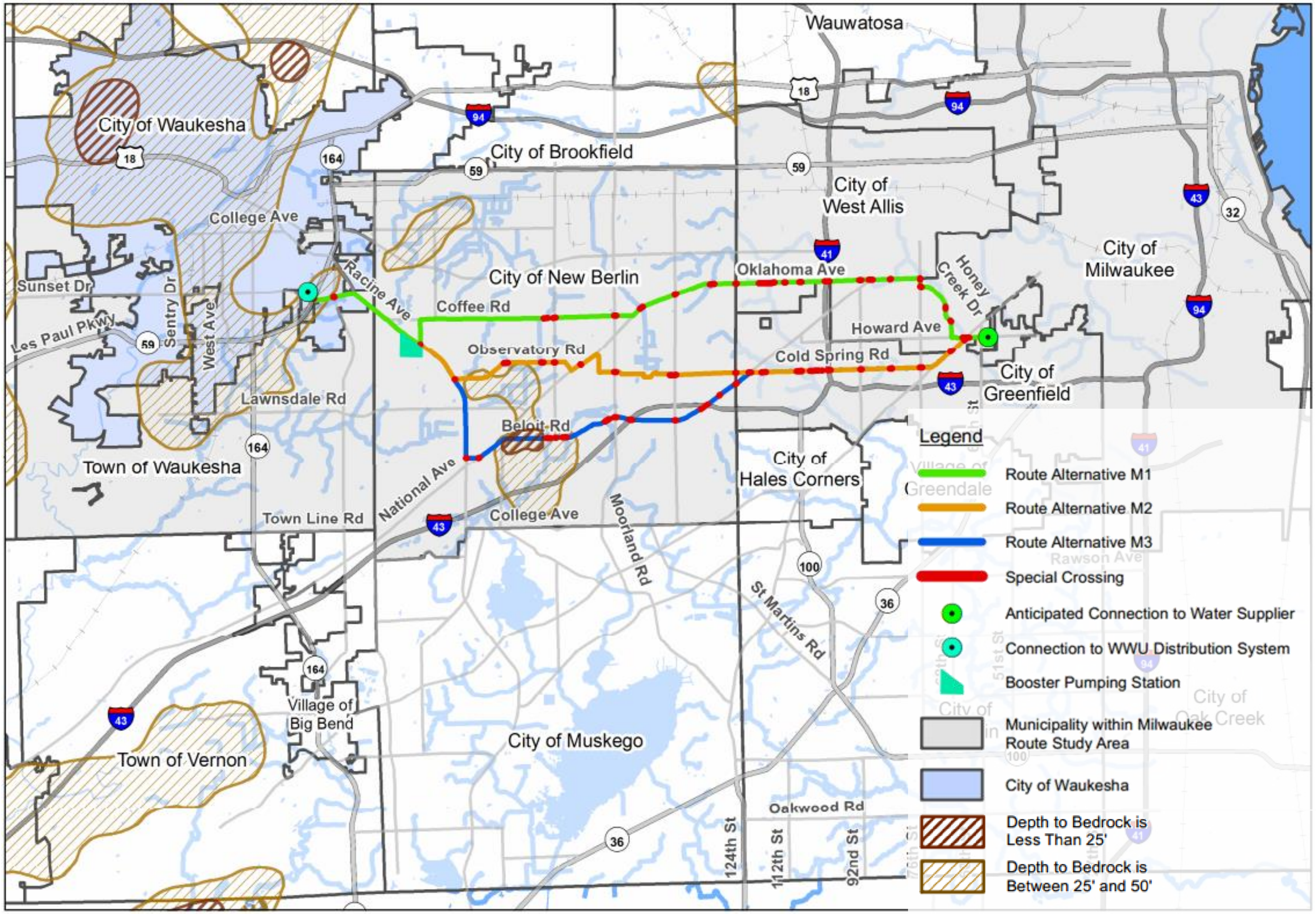
***Note: Pipeline lengths for all route alternatives are based on the lengths between the anticipated connection point in Milwaukee near 60th Street and Howard Avenue, and the WWU distribution connection at Sunset Drive and Route 59.**

Longer pipeline length increases the potential for latent defects (e.g., future leaks) and requires additional pipeline appurtenances that must be maintained.

More special crossings are generally indicative of effects to scheduling, more aquatic resources impacts, more risk and more permitting, more cost.

Route Alternative M2 has a shorter length of pipeline and special crossings, while Route Alternative M3 has a longer length of pipeline and special crossings.

Non-Economic Analysis: Depth to Bedrock



Non-Economic Analysis: Depth to Bedrock

Geotechnical Soil Analysis: Depth to Bedrock*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
<25 feet	0 LF	0 LF	3,800 LF
25-50 feet	5,000 LF	9,400 LF	17,800 LF

*Source - SEWRPC

Shallow bedrock can increase cost and duration of construction.

Route Alternative M1 has less pipeline length through suspected shallow bedrock, while Route Alternative M3 has more pipeline length through suspected shallow bedrock.

Depths to bedrock will be confirmed with borings for the preferred route.

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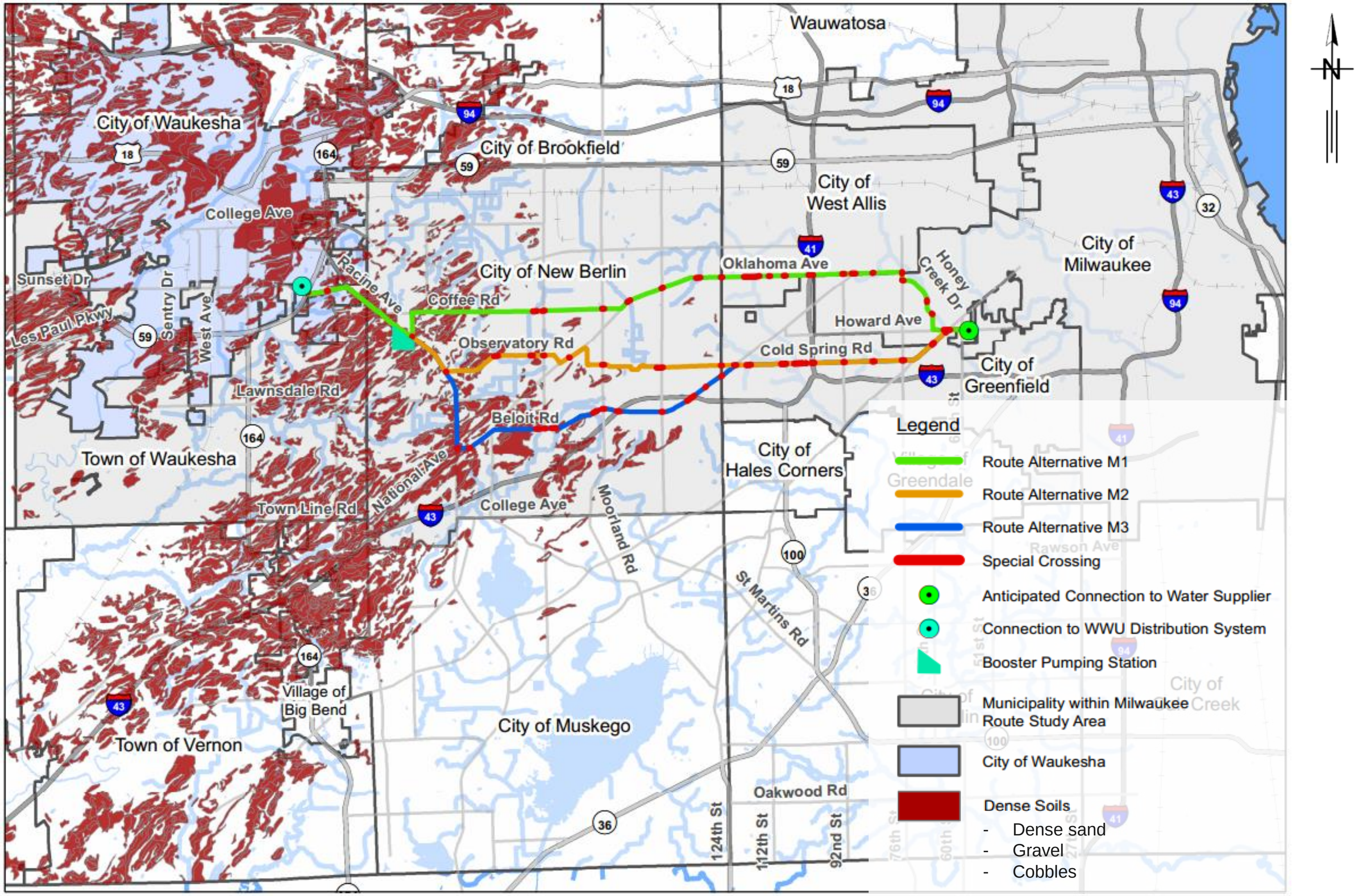
Non-Economic Analysis: Dense Soils



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Non-Economic Analysis: Dense Soils

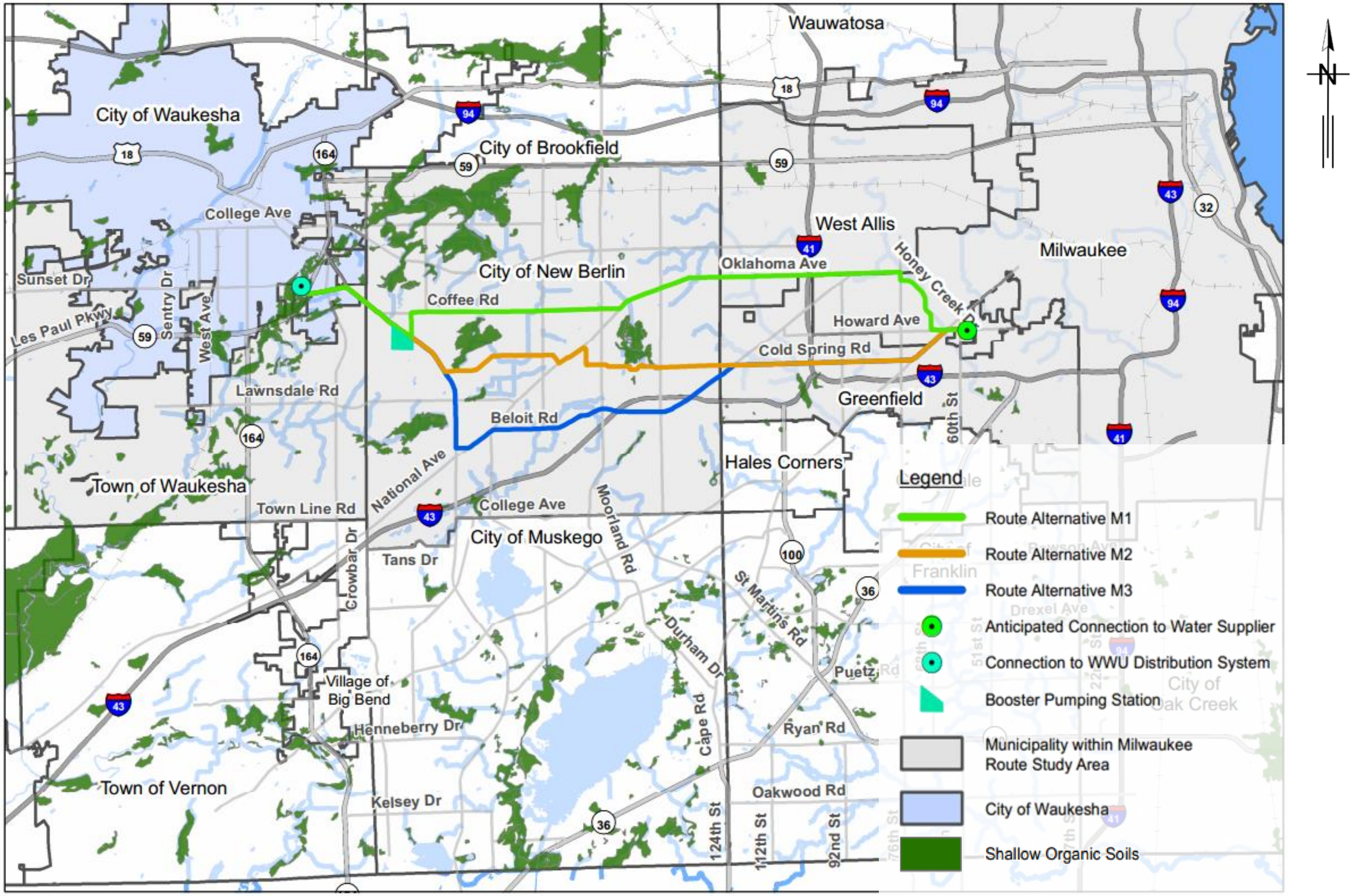
Geotechnical Soil Analysis: Dense Soils*			
Evaluation Item	Route Alternatives		
	M1	M2	M3
Length within Dense Soils	7,800 LF	10,600 LF	18,300 LF

***Source – USDA/NRCS, Bulk Density Testing**

Dense soils indicate the presence of gravel, cobbles, or dense sand. Dense soils lengths were developed utilizing the NRCS's Web Soil Survey online tool. More dense soils can impede construction, increasing cost and schedule.

Route Alternative M1 has less pipeline length through suspected dense soils, while Route Alternative M3 has more pipeline length through suspected dense soils.

Non-Economic Analysis: Organic Soils



Non-Economic Analysis: Organic Soils

Geotechnical Soil Analysis: Organic Soils*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Length within Organic Soils	400 LF	0 LF	0 LF

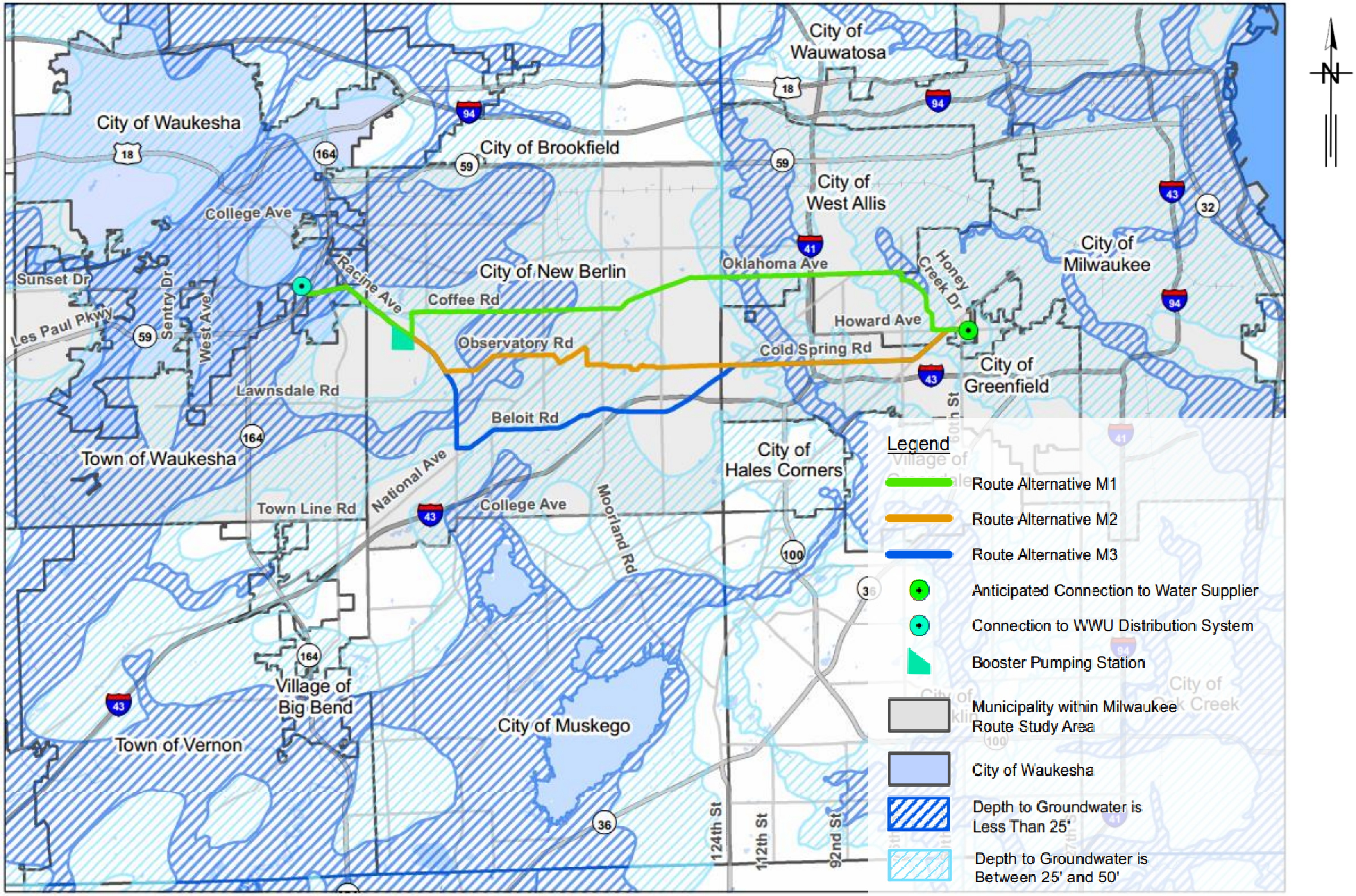
*Source – USDA/NRCS

The presence of organic soils may require over excavation and additional backfill materials that can impact cost and schedule.

Route Alternative M1's only segment through suspected organic soils is along Honey Creek Drive. This organic soil may have been removed and replaced during development.

Route alternatives are comparable in terms of suspected organic soils.

Non-Economic Analysis: Depth to Groundwater



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Non-Economic Analysis: Depth to Groundwater

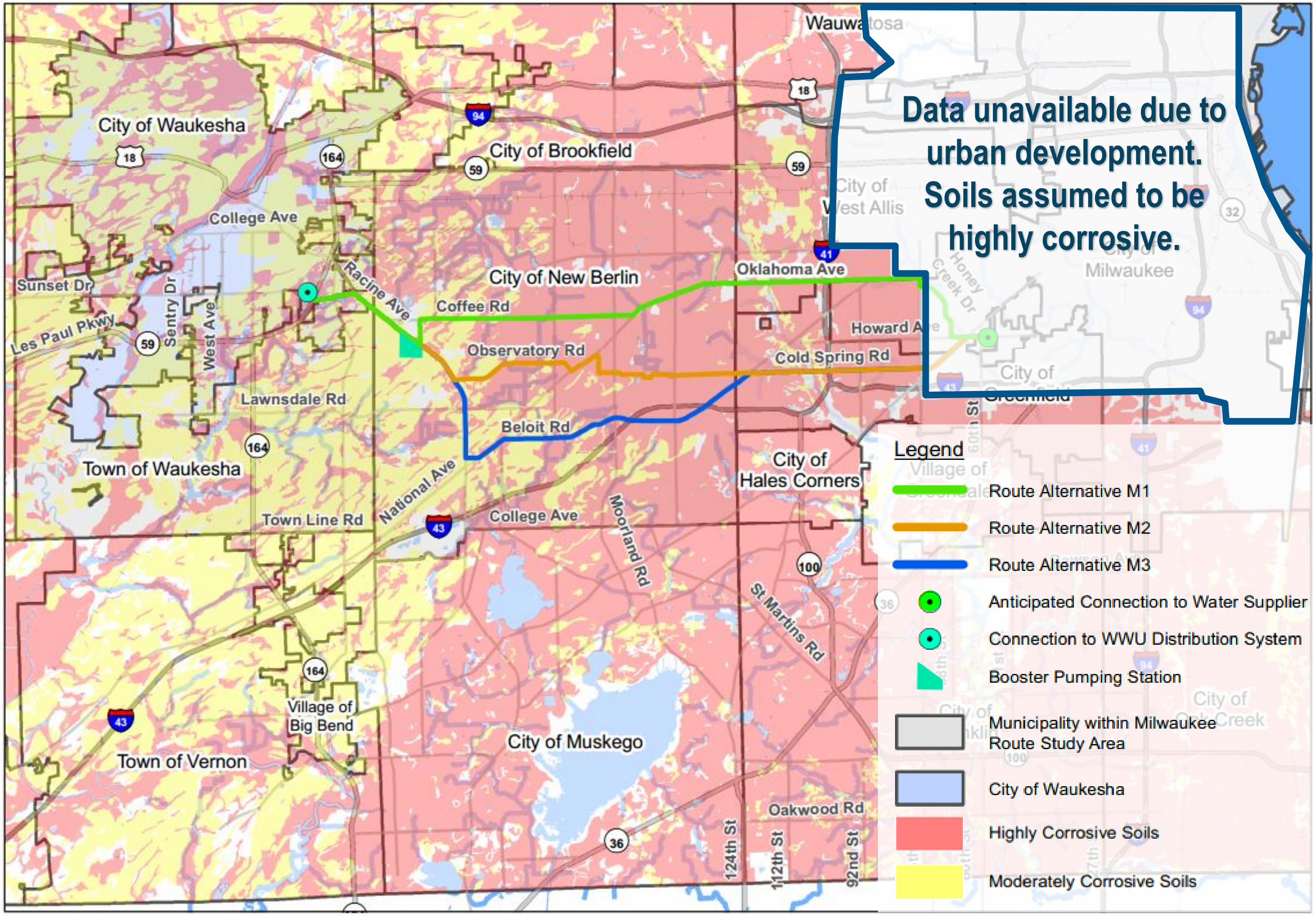
Geotechnical Soil Analysis: Depth to Groundwater*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Total Length over Shallow Groundwater (0-25 feet in depth)	30,600 LF	20,600 LF	15,200 LF

***Source – USDA/NRCS**

Shallow groundwater can increase the need for dewatering and the general complexity of open cut and trenchless construction via jack and bore method.

Route Alternative M1 has more pipeline length through areas of suspected shallow groundwater, while Route Alternative M3 has less pipeline length through areas of suspected shallow groundwater.

Non-Economic Analysis: Corrosive Soils



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Non-Economic Analysis: Corrosive Soils

Geotechnical Soil Analysis: Corrosive Soils*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Length within Soils Corrosive to Steel/Ductile Iron	40,700 LF	48,400 LF	44,700 LF

*Source – USDA/NRCS

Corrosive soils can impact the level of corrosion protection required along the pipelines that can impact design and cost.

Route Alternative M1 has less pipeline length through areas of suspected corrosive soils, while Route Alternative M2 has more pipeline length through areas of suspected corrosive soils to ductile iron and steel pipe.

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Non-Economic Analysis: Contaminated Materials

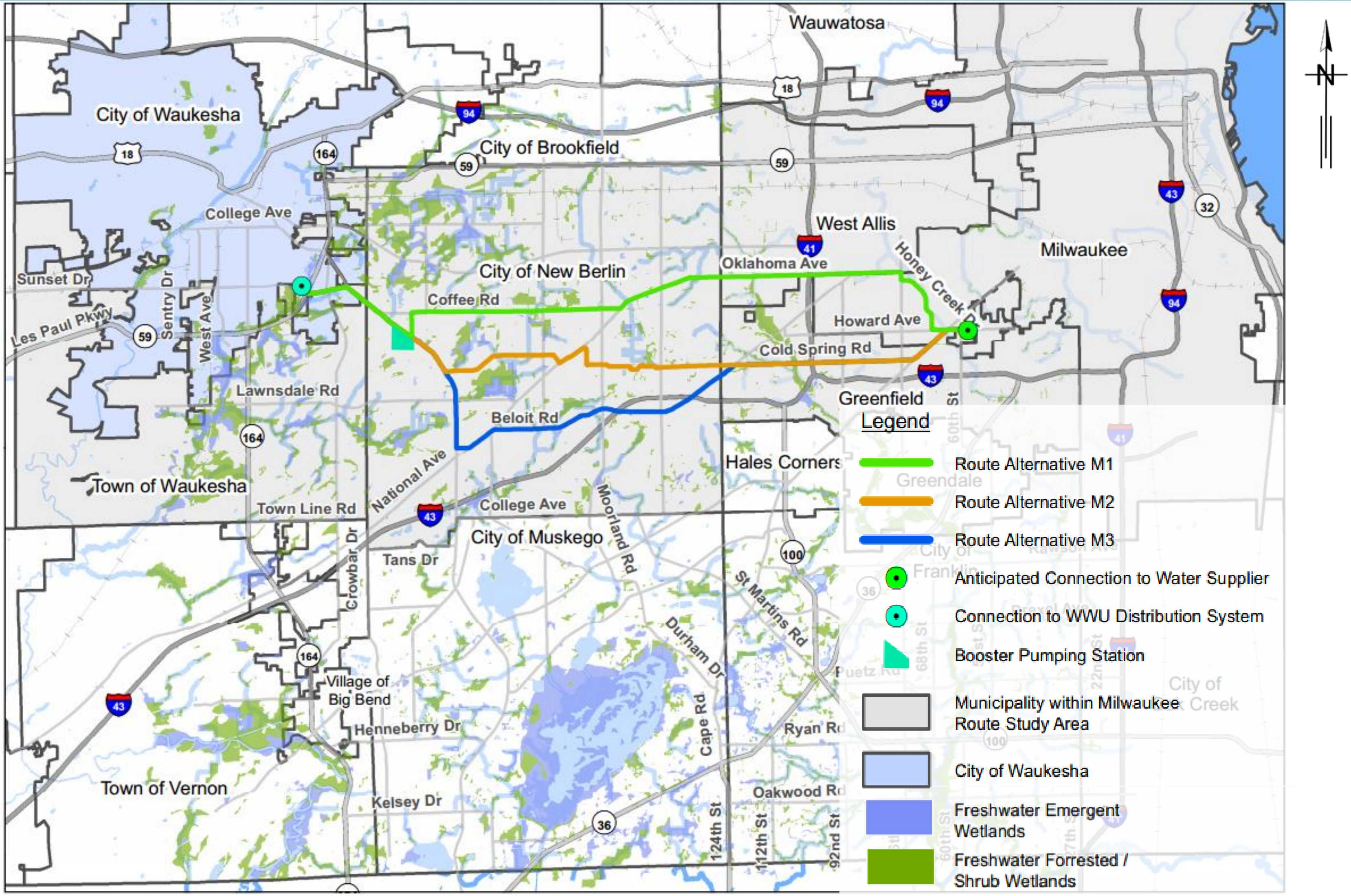
Contaminated Materials*			
Potential Impact Rank (1=Low Risk, 5=High Risk)	Route Alternatives		
	M1	M2	M3
	Number of Sites by Impact Rank		
1	39	31	41
2	20	15	14
3	8	8	8
4	11	4	6
5	8	3	4
Total Ranking Score on Route	**86**	**61**	**73**
Total Number of Sites Encountered on Route	**187**	**116**	**137**

***Sources – Environmental Risk Information Services, WDNR, Historical Documents**

Contaminated materials can impact the cost and duration of construction by changing hauling and disposal requirements.

Route Alternative M2 is routed in proximity to fewer suspected contaminated material sites, while Route Alternative M1 is routed in proximity to more suspected contaminated material sites.

Non-Economic Analysis: Wetlands



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Non-Economic Analysis: Wetlands

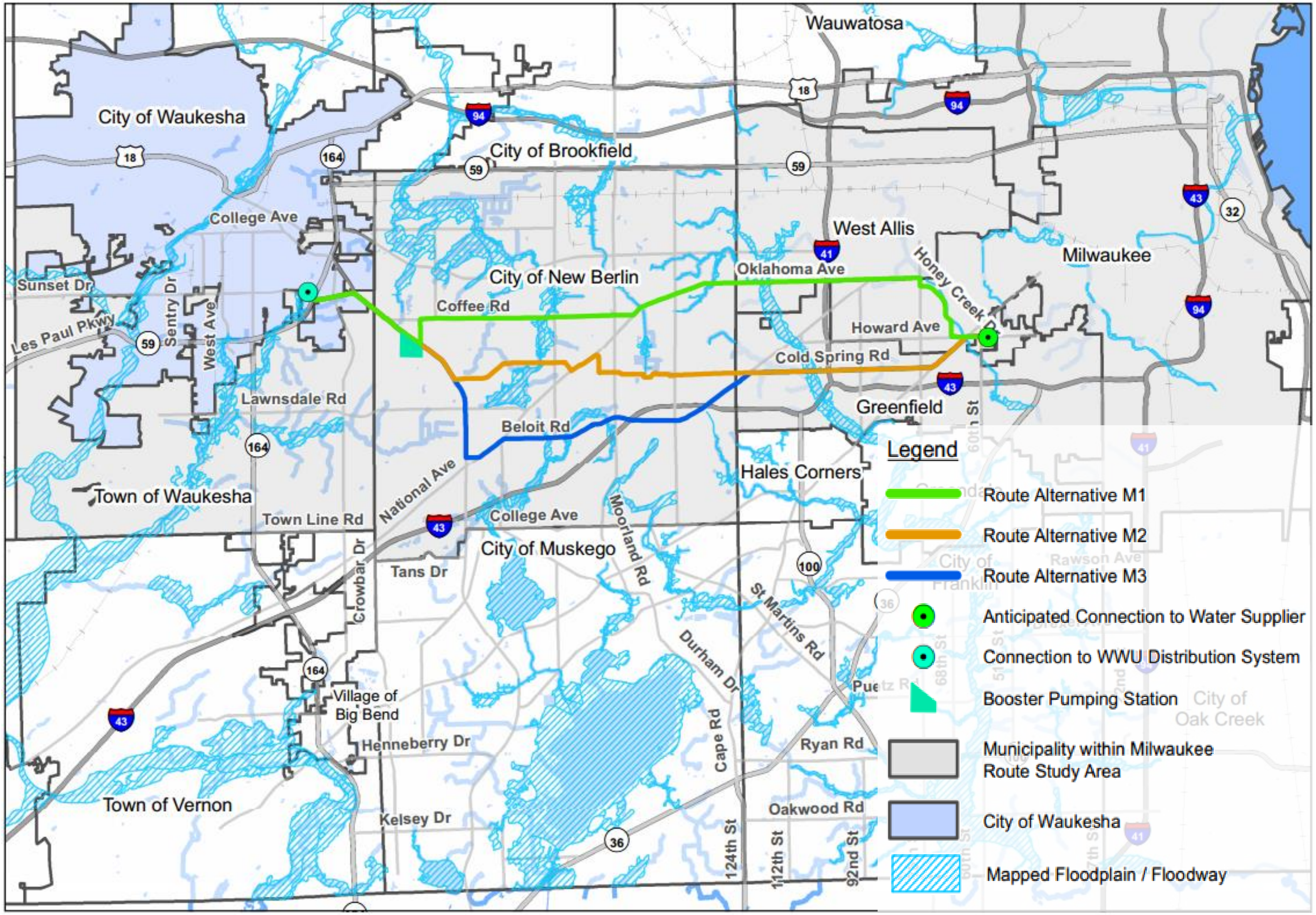
Mapped Wetland Impacts*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Total Number of Wetlands	41	73	113
Wetlands within Right-of-Way	2.8 ac	1.5 ac	3.1 ac
Wetlands within Easements	0	0	0
Total	2.8 ac	1.5 ac	3.1 ac

***Sources – Digital Wetland Inventory (From WDNR), the Wisconsin Wetland Inventory, & NRCS Soil Maps**

Wetland impacts can affect regulatory mitigation and schedule.

Route alternatives are comparable in terms of potential wetland impacts.

Non-Economic Analysis: Waterways



Non-Economic Analysis: Waterways

Potential Waterway Crossings*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Miles of Waterways within Right-of-way	0.19	0.14	0.16
Total Number of Waterway Crossings	8	8	8
Named Waterway Crossings	**1**	**1**	**1**
Unnamed Waterway Crossings	7	7	7

***Sources – WDNR & USGS Topographic Maps**

Waterways can impact the length of HDD segments of the pipelines required, cost, and permitting effort.

Route alternatives are comparable in terms of waterways.

Non-Economic Analysis: Endangered Resources

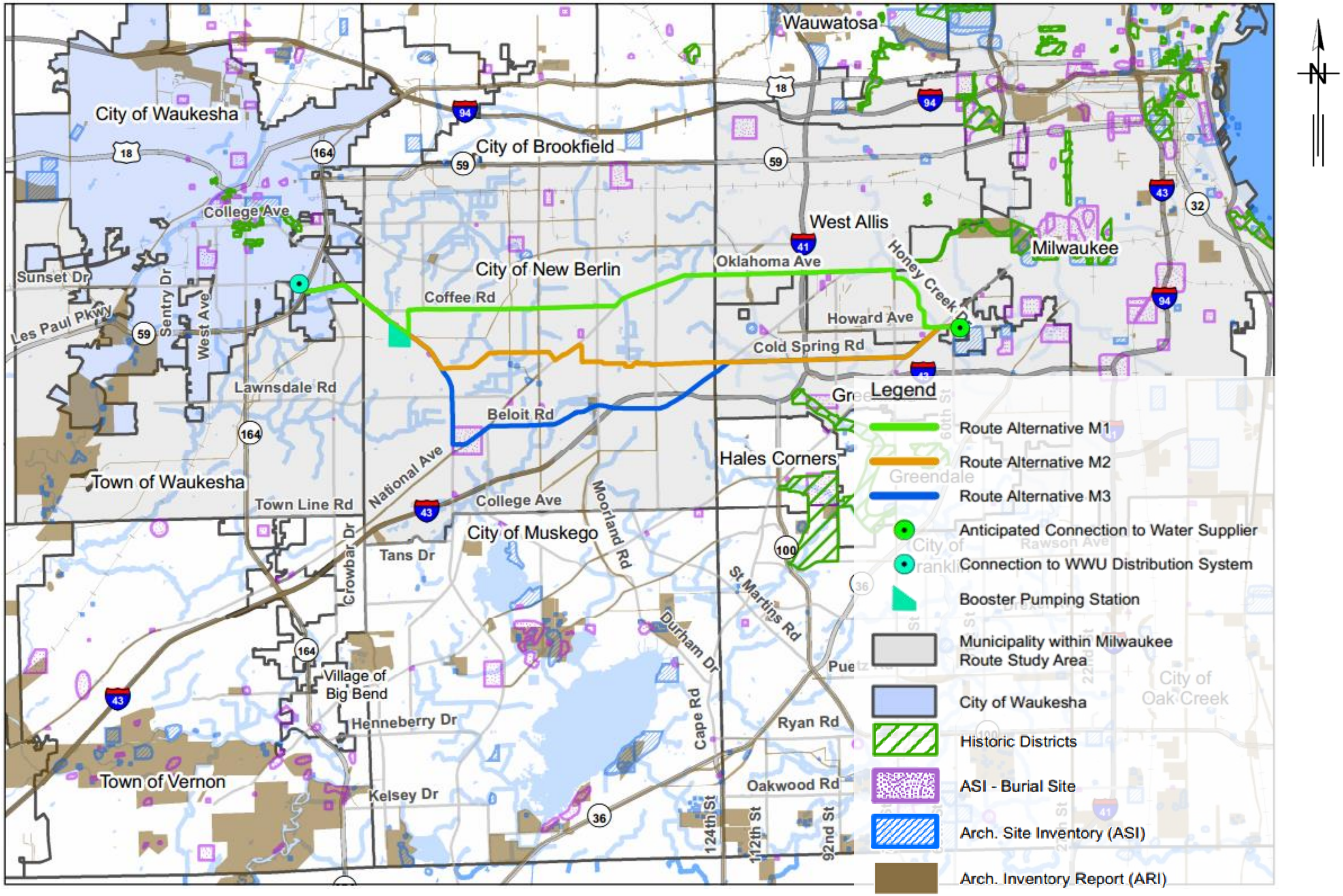
Endangered Resources*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Resources with Required Measures	0	0	0
Resources with Recommended Measures	4	5	4
Resources with No Impact	8	3	3
Federal Rare, Threatened, and Endangered Species	6	6	6
USFWS Bumble Bee Low Potential Zone	2	2	2
USFWS Bumble Bee High Potential Zone	0	0	0

***Sources – WDNR Natural Heritage Inventory, USFWS Information Planning and Consultation data**

Endangered resources can affect the length of construction and permitting effort. Fewer endangered resources are generally indicative of less risk of schedule delays and less permitting. Recommended measures for endangered resources include time of year restrictions, exclusion fencing, and erosion control

Route Alternatives M1 and M3 are comparable and are in proximity to fewer suspected endangered resources, while Route Alternative M2 is in proximity to more suspected endangered resources.

Non-Economic Analysis: Cultural Resources



Non-Economic Analysis: Cultural Resources

Cultural Resources*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Archaeological Sites	0	0	1
Burial Sites	1	2	3
Historic Structures	0	0	1
NRHP Listed	0	0	0

***Source – Wisconsin Historical Society**

Cultural resources will require Phase I survey to comply with the National Historic Preservation Act.

Route Alternative M3 is routed in proximity to additional archaeological sites, burial sites, and historic structures, while Route Alternative M1 is routed in proximity to fewer cultural resources sites.

Non-Economic Analysis: Agricultural Lands

Agricultural Lands*			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Certified Organic Farms	0	0	0
Easements Agricultural Land (ac.)	0	0	0

***Sources – Waukesha County Open Data Portal Website, Milwaukee County Land Information Office Geospatial data, USDA Organic Integrity Database, & the Organic Agriculture in Wisconsin 2017 & 2015 Status Reports**

Agricultural impacts can increase the regulatory and permitting effort with the PSC and WDNR, especially when considering organic farms.

Route alternatives are comparable in terms of agricultural lands.

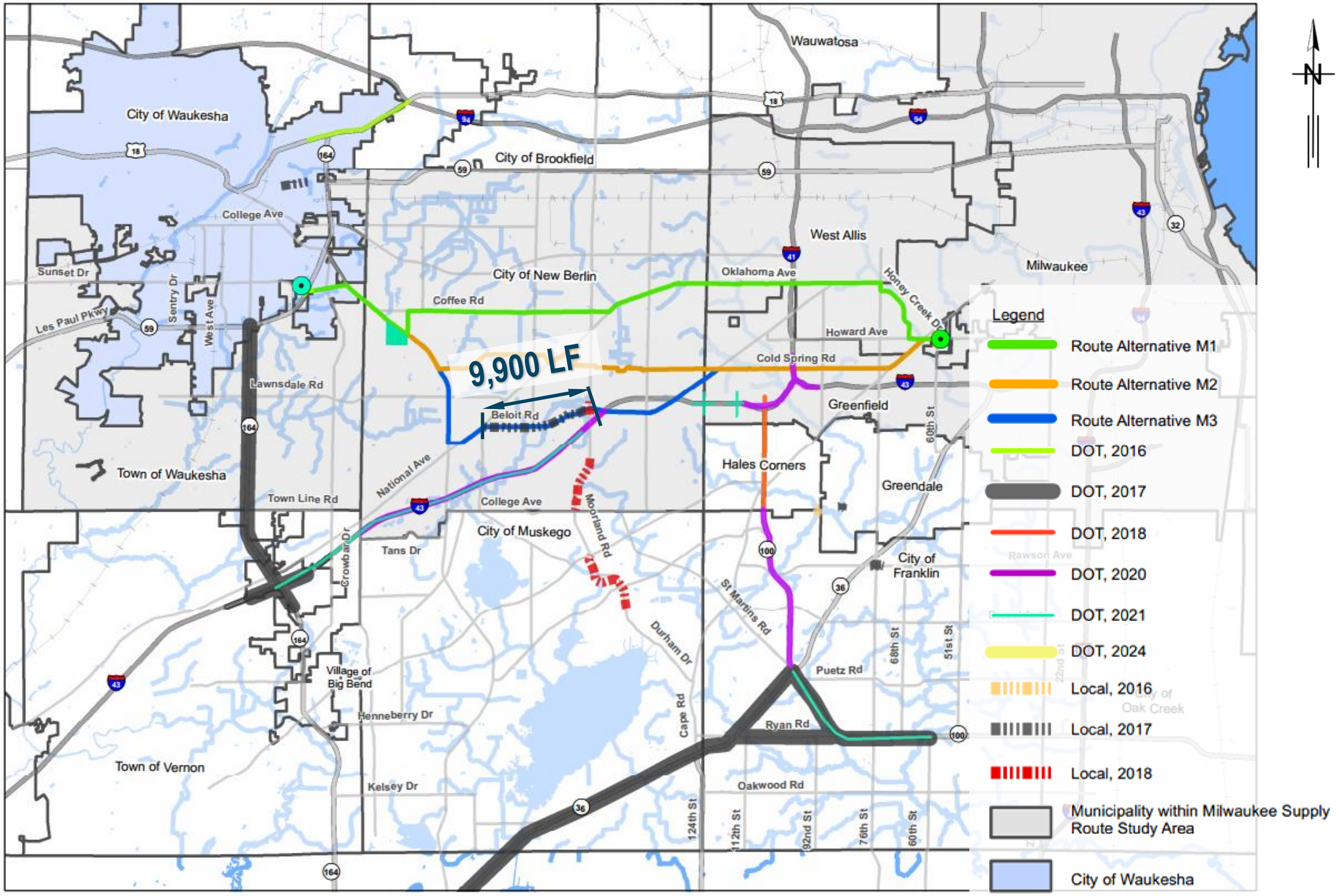
Non-Economic Analysis: Transportation

Transportation				
	Route Alternatives			
Evaluation Item	Common	M1	M2	M3
Total Roadway Length	2.5 mi	10.5 mi	10.1 mi	11.3 mi
Total Roadway Pavement Area	24,000 sf	527,000 sf	453,000 sf	394,000 sf
Total Additional Travel Distance from Detours	0 mi	122,000 mi	317,000 mi	1,759,000 mi
Total Lost Travel Time from Detours	0 hrs	5,700 hrs	57,900 hrs	76,400 hrs

Transportation affects maintenance of traffic requirements, ease of construction, cost, and public acceptability.

Route Alternative M1 is anticipated to have less travel detour distance and detour hours, while Route Alternatives M2 and M3 are anticipated to have more travel detour distance and detour hours.

Non-Economic Analysis: Planned Regional Transportation Projects



Non-Economic Analysis: Planned Regional Transportation Projects

Recent or Planned Regional Transportation Projects – Length Along Route Alternatives (LF)			
Anticipated Year of Construction	Route Alternatives		
	M1	M2	M3
2017	0	0	9,900
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0	0
Total	**0**	**0**	**9,900 LF**

Recent or planned regional transportation projects that overlap routes anticipated before construction can affect design, schedule, cost, and permitting. Where regional transportation projects are planned during Program construction, opportunities exist to take advantage of potential synergies, such as sharing maintenance of traffic and surface restoration costs between the two projects.

Route Alternative M3 is routed along more recently completed or planned regional transportation projects than Route Alternatives M1 and M2.

Non-Economic Analysis: Energy Consumption

Energy Consumption			
	Route Alternatives		
Items	M1	M2	M3
WSPS Total Head (ft)	430	430	450
BPS Total Head (ft)	150	150	150
Total Head Required (ft)	**580**	**580**	**600**

Energy consumption impacts operational costs.

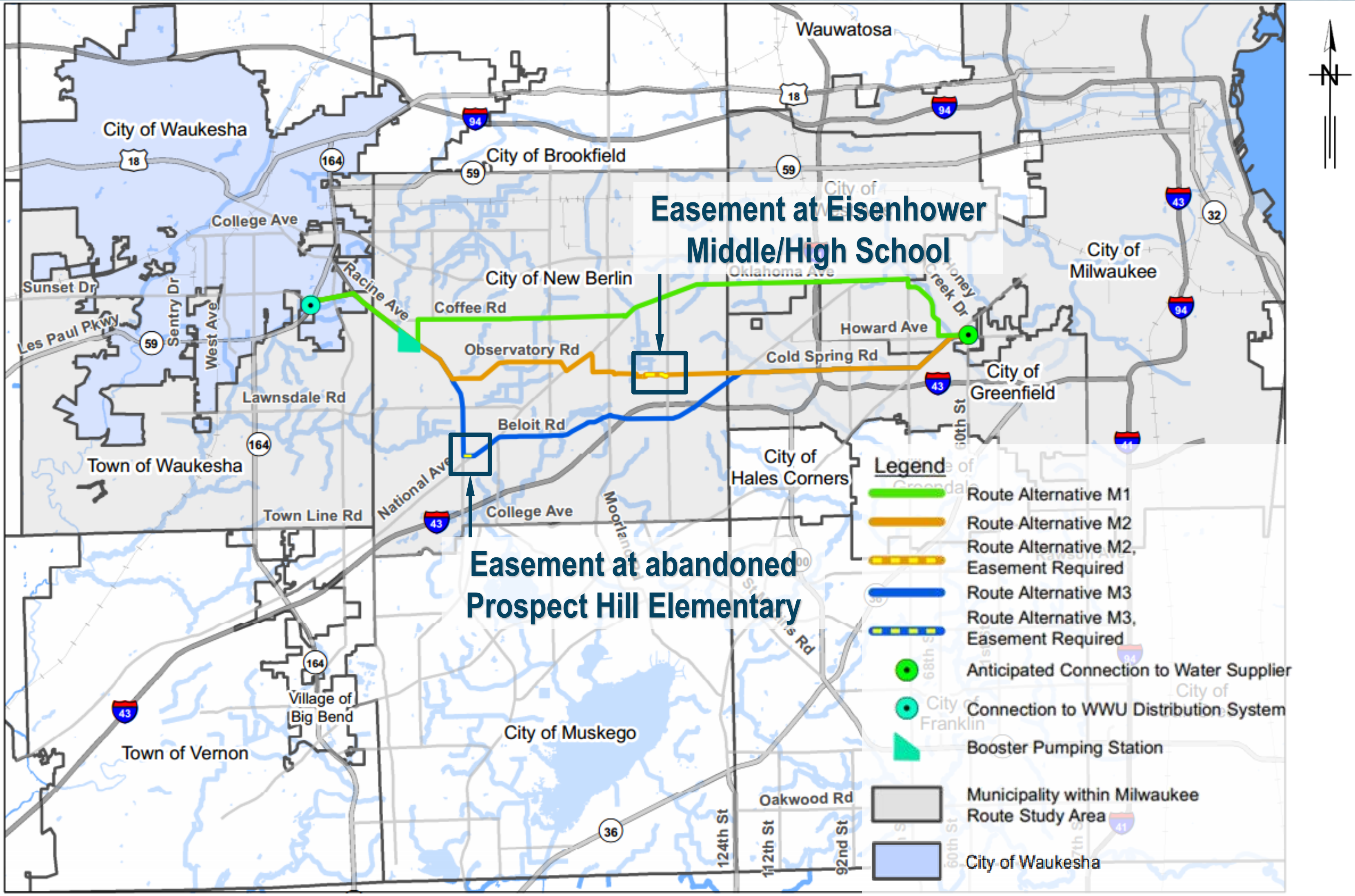
Route Alternative M3 has a longer pipeline length, which increases head loss and energy consumption. Route Alternatives M1 and M2 are comparable and are anticipated to consume less energy.

Non-Economic Analysis: Stakeholder Feedback

- West Allis
  - February 12, 2018
- Greenfield
  - February 14, 2018
- New Berlin
  - February 15, 2018
- Milwaukee
  - April 4, 2018

For discussion…

Non-Economic Analysis:
Real Property and Easement Requirements



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Non-Economic Analysis:
Real Property and Easement Requirements

Real Property and Easement Requirements			
	Route Alternatives		
Items	M1	M2	M3
Number of Easements	0	1	1
Acreage of Easements	0	2.9 ac	1.1 ac

More easements can increase costs and pose risks to additional pipeline length and schedule delays if the property owner is not amenable to the easement.

Route Alternative M1 requires no easements. Route Alternative M2 requires the most acreage through easements and could also require a construction phasing restriction. Although there is an easement on Route Alternative M3, the property is abandoned and could potentially be used as a construction lay-down area.

Non-Economic Analysis: Real Property and Easement Requirements

Non-Economic Analysis: Comparison

Non-Economic Analysis			
Evaluation Item	Route Alternatives		
	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils	Comparable		
Depth to Groundwater	More	Fair	Less
Corrosive Soils	Less	More	Fair
Contaminated Materials	More	Less	Fair
Wetlands	Comparable		
Waterways	Comparable		
Endangered Resources	Less	More	Less
Cultural Resources	Less	Fair	More
Agricultural Resources	Comparable		
Transportation (i.e., Maintenance of Traffic)	Less	More	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges	For discussion		
Real Property and Easement Requirements	Less	More	Fair

Route Alternative M3 is less preferable due to:

- **Increased pipeline length**
- **Increased special crossing length**
- **Potential increased occurrence of shallow bedrock and dense soils**
- **Additional risks to cultural resources impacts**
- **Additional maintenance of traffic requirements**
- **Additional conflicts with recently completed or planned regional transportation projects**
- **Additional energy consumption**

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Non-Economic Analysis: Comparison

Non-Economic Analysis			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils		Comparable	
Depth to Groundwater	**More**	Fair	Less
Corrosive Soils	Less	**More**	Fair
Contaminated Materials	**More**	Less	Fair
Wetlands		Comparable	
Waterways		Comparable	
Endangered Resources	Less	**More**	Less
Cultural Resources	Less	Fair	More
Agricultural Resources		Comparable	
Transportation (i.e., Maintenance of Traffic)	Less	**More**	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges		For discussion	
Real Property and Easement Requirements	Less	**More**	Fair

Route Alternative M2 is less preferable with respect to Route Alternative M1 due to:

- **Additional length through suspected areas of corrosive soils**
- **Additional maintenance of traffic requirements**
- **Potential for additional stakeholder challenges**
- **Additional easement requirements that also pose a risk to longer pipeline length and schedule impacts**
- **Additional construction challenges through narrow corridors**

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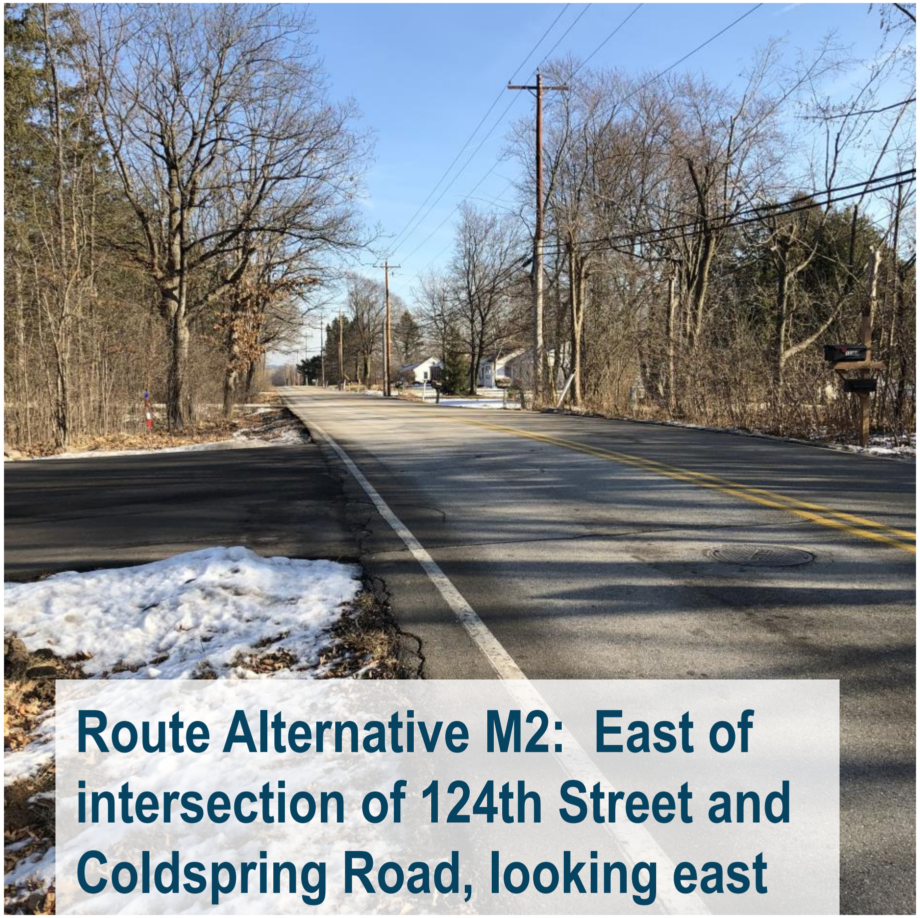
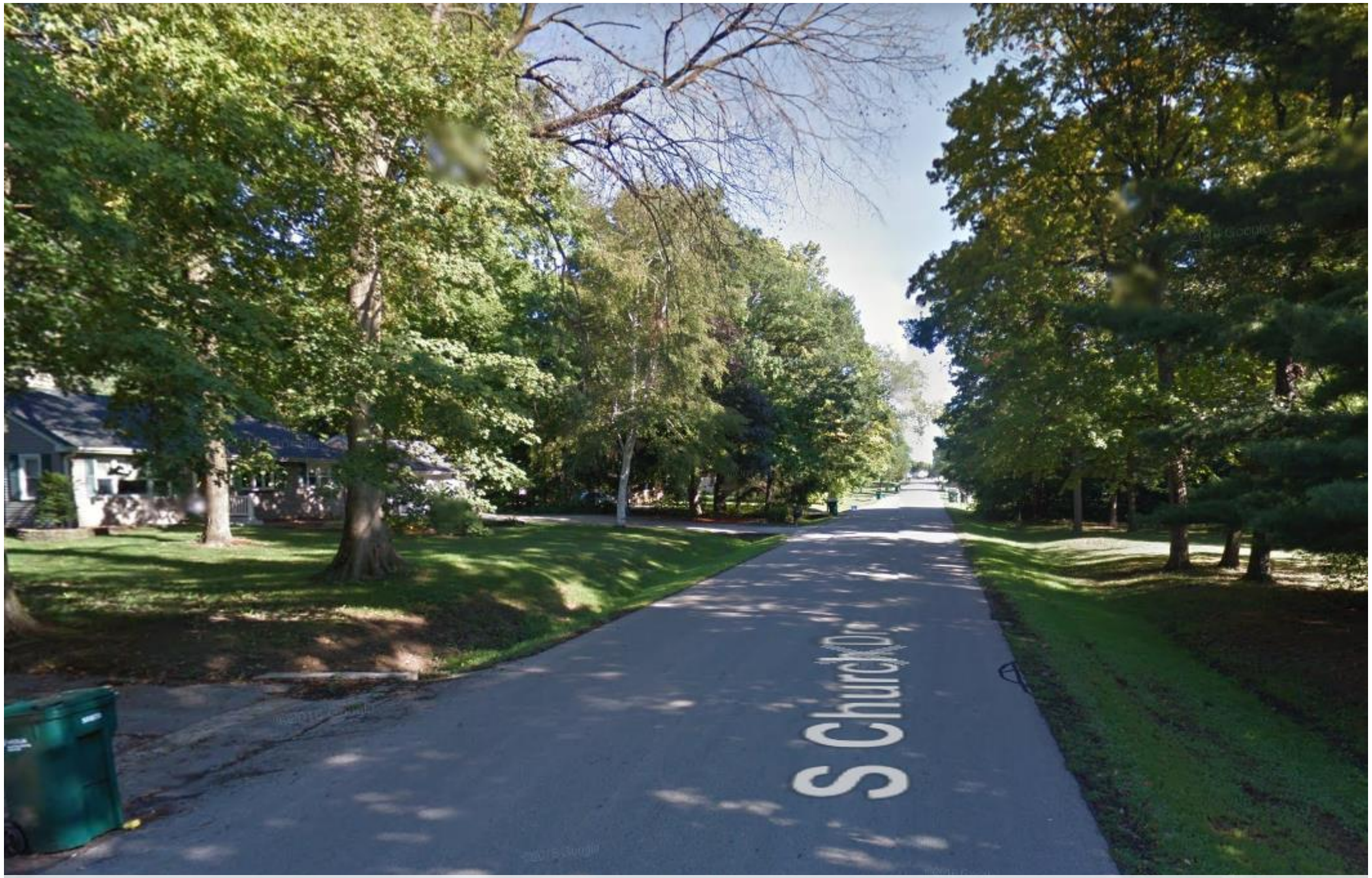
Non-Economic Analysis: Comparison



Non-Economic Analysis: Comparison

Route Alternative M2: Intersection of Katherine Drive and Mayflower Drive, looking west (neighborhood west of Eisenhower middle/high school)

Non-Economic Analysis: Comparison



Route Alternative M2: Intersection of Church Drive and Mayflower Drive, looking north (neighborhood west of Eisenhower middle/high school)

Non-Economic Analysis: Comparison

Non-Economic Analysis			
	Route Alternatives		
Evaluation Item	M1	M2	M3
Pipeline Length	Fair	Less	More
Special Crossings	Fair	Less	More
Depth to Bedrock	Less	Fair	More
Dense Soils	Less	Fair	More
Organic Soils		Comparable	
Depth to Groundwater	More	Fair	Less
Corrosive Soils	Less	More	Fair
Contaminated Materials	More	Less	Fair
Wetlands		Comparable	
Waterways		Comparable	
Endangered Resources	Less	More	Less
Cultural Resources	Less	Fair	More
Agricultural Resources		Comparable	
Transportation (i.e., Maintenance of Traffic)	Less	More	Most
Planned Regional Transportation Projects	Less	Less	More
Energy Consumption	Less	Less	More
Stakeholder Feedback Challenges		For discussion	
Real Property and Easement Requirements	Less	More	Fair

Route Alternative M1 is preferred on a non-economic basis.

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Non-Economic Analysis: Comparison

Route Alternative M1: Intersection of 100th Street and Oklahoma Avenue, looking east

Non-Economic Analysis: Comparison

Route Alternative M1: Intersection of Calhoun Road and Coffee Road, looking east

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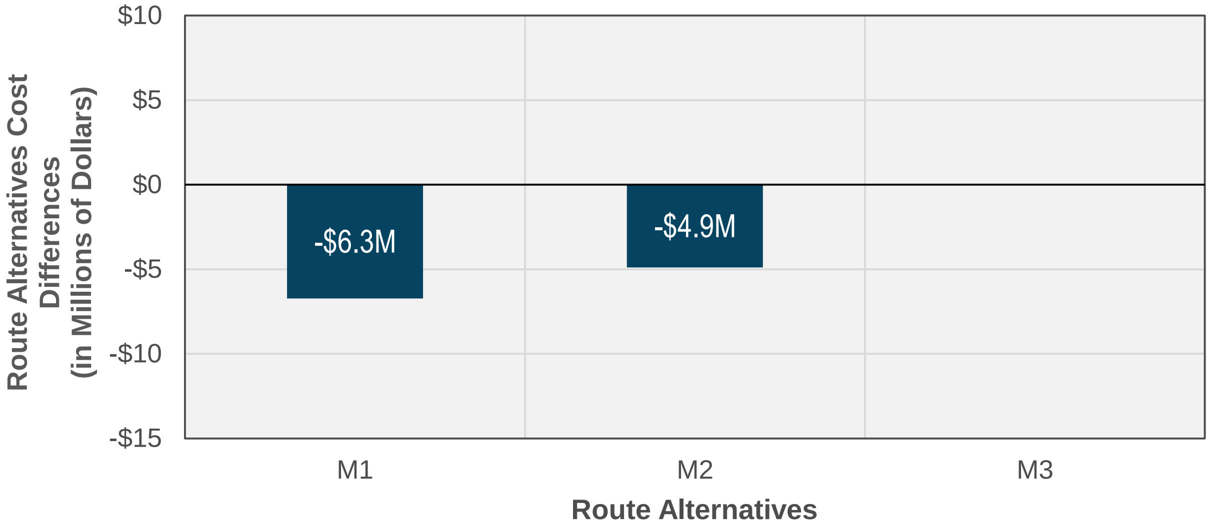
Economic Analysis

Economic Analysis: Program Costs

Program Cost ($M, June 2017 ENR CCI = 10,942)			
	Route Alternatives		
Cost Item	M1	M2	M3
Program Cost Difference ($M)	-6.3	-4.9	0.0



Route Alternatives M1 and M2 are less costly than Route Alternative M3. Route Alternative M1 is least costly.

Route Alternative M2 has risks of increased cost due to:

- **Increased pipeline length (estimated an additional $3.1M in Program Costs to avoid Eisenhower School easement by utilizing Sunny Slope Road to Oklahoma Avenue)**
- **Additional surface restoration and utility relocation**

Route Scoring

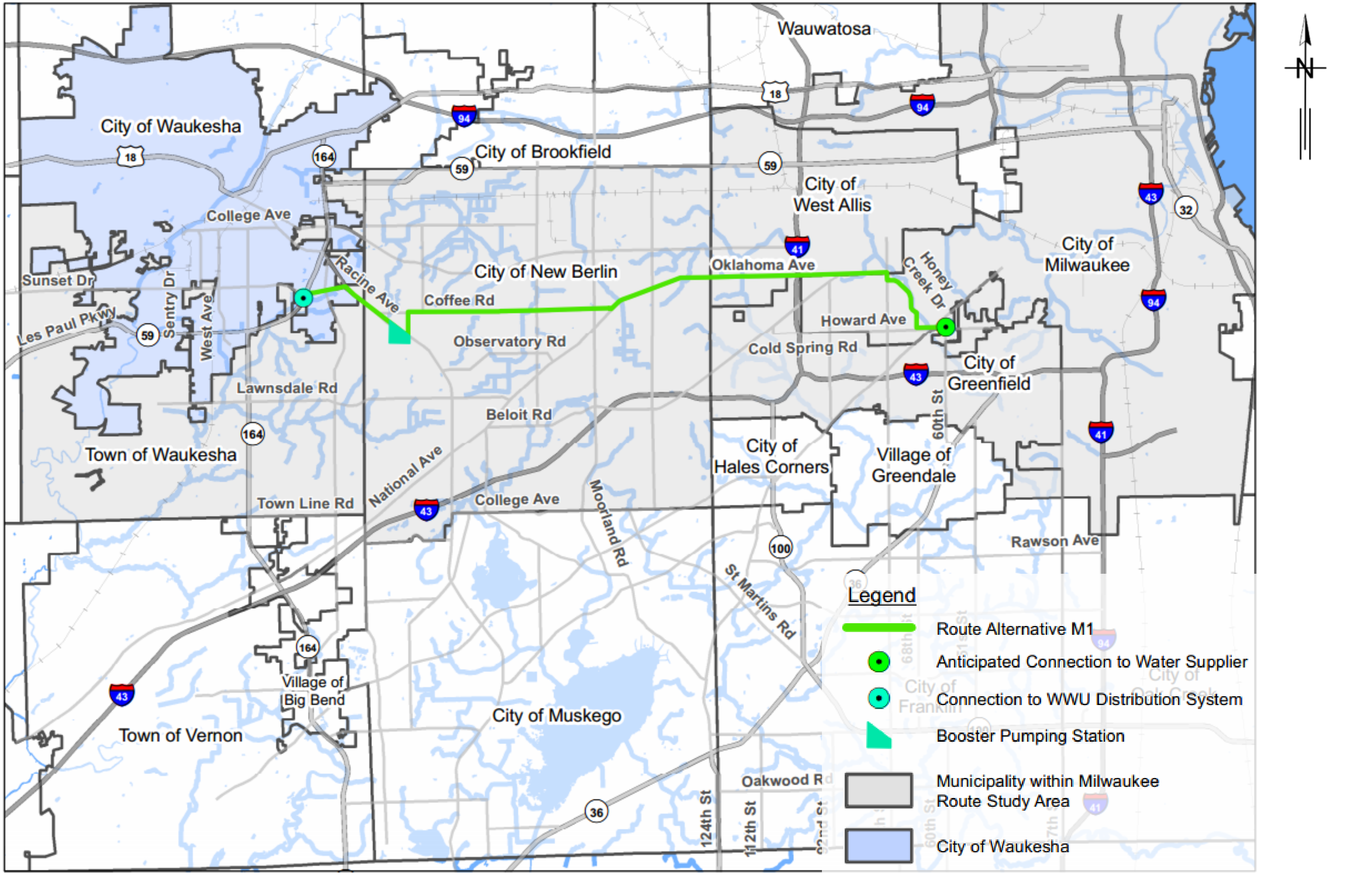
Route Scoring: Key Performance Indicator Metrics

Key Performance Indicator	Metrics
Capital Cost	Capital Cost (U.S Dollars)
Schedule	Days (Determined by Linear Feet of Pipe / Day)
Operations	Number of Pressure Release Valves, Number of Connections to the Distribution System, Distribution System Pressure (psi)
Future Expansion	Number of Municipalities Traversed, Average Daily Demand of Municipalities Traversed (MGD)
Environmental Impact	Acreage of WWI Mapped and Photo-Interpreted Wetlands, Number of Waterways Crossed, Endangered Species
Public Acceptability	Protected Resources (# of Archaeological, Burial, and Historic Sites), Transportation (Linear Feet of Roadway Impacts, Square Footage of Pavement Area, Additional Driving Hours), Number of Easements, Agriculture (Acreage in the 50-ft buffer, Acreage in the Easements), Coordination with Planned Construction
System Reliability	Length of Pipe (LF), Accessibility (Number of Special Crossings, Number of Easements), Max Pressure (psi)
Ease of Construction	Depth to Bedrock (LF of Pipe < 50ft deep), Dense Soils (LF of Pipe), Organic Soils (LF of Pipe), Depth to Groundwater (LF of Pipe < 6ft deep), Soils Corrosive to Steel/Ductile Iron (LF of Pipe), Soils Corrosive to PCCP (LF of Pipe), Contaminated Materials (Total Ranking Score on each Route)
Life Cycle Cost	Capital Cost (U.S. Dollars), Energy Cost (U.S. Dollars)
Cost Sharing Potential	Number of Municipalities Traversed, Simultaneous Planned Construction Projects
Effects on Ability to Finance	Envision Score

Route Scoring:
Triple Bottom Line Analysis

	Criteria	Actual Weights	Maximum Possible Score	Route Alternatives		
				M1	M2	M3
1	***Social and Community Goals***					
1.1	*Schedule*	*14.0*	*5*	3	2	2
1.2	*Public Acceptability*	*6.5*	*5*	5	2	3
1.3	*Operations*	*6.0*	*5*	3	3	3
1.4	*Future Connections*	*6.0*	*5*	3	3	4
2	***Economic Goals***					
2.1	*System Reliability*	*19.0*	*5*	3	3	3
2.2	*Life Cycle Cost*	*15.5*	*5*	3	3	3
2.3	*Ease of Construction*	*11.0*	*5*	4	2	3
2.4	*Capital Cost*	*6.0*	*5*	3	3	2
2.5	*Ability to Finance*	*6.0*	*5*	4	2	3
2.6	*Cost Sharing Potential*	*5.0*	*5*	3	3	4
3	***Environmental Goals***					
3.1	*Environmental Impact*	*5.0*	*5*	3	3	3
	Net TBL Score	100	500	**330**	**263**	**291**
	Percent of Max Possible Score		NA	**66%**	**53%**	**58%**

Route Scoring: Preferred Water Supply Route



Waukesha Water Utility GREELEY AND HANSEN

Summary Wrap-Up and Action Items

Summary Wrap-Up and Action Items

- Reviewed Non-Economic Analysis for Route Alternatives
- Reviewed Economic Analysis for Route Alternatives
- Presented Route Scores and Gained Consensus on the Preferred Route

THANK YOU

MEETING SUMMARY

The Great Lakes Water Supply Program (Program) Preliminary Design Meeting on Pipeline Horizontal Separation was held at the Wisconsin Department of Natural Resources (WDNR) Room No. 728 at 3:00 p.m. on October 17, 2017. The purpose of the meeting was to gain consensus on minimum horizontal separation distance allowed between Water Supply and Return Flow Pipelines. The attendees are listed on the attached sign-in sheet. The handout materials are also attached.

	Action Item	Action By	Due Date
1.	Share information regarding pipe classifications (stormwater vs. raw sewage force mains) for treated wastewater effluent mains permitted in previous projects.	J. Knutson	**11/18/17**
2.	Schedule meeting to discuss pressure classes for Water Supply and Return Flow Pipelines after water supplier is selected.	T. Bluver	**1/12/18**

1) Welcome

a) The agenda and meeting objectives were discussed.

2) Background

a) An overview of the Program was discussed, including descriptions of the Water Supply and Return Flow Pipelines, and the associated facilities.

b) The length of Common Corridor, or corridors containing both the Water Supply and Return Flow Pipelines, could be significant. The implications of a narrower minimum horizontal separation in certain segments would allow minimization of public disruption, more design flexibility, reduction in environmental impacts, and reduced costs.

3) Review of Regulations

a) NR 811.74 was reviewed. WDNR acknowledged current regulations do not specifically govern reclaimed mains, or mains conveying highly treated wastewater effluent, such as the Return Flow Pipeline.

b) WDNR confirmed it is acceptable to design the Water Supply and Return Flow Pipelines with a minimum horizontal separation of 8-feet, measured center-to-center, without pursuing exceptions. An 8-foot center-to-center horizontal separation would correspond to a 5-foot edge-to-edge (i.e., clear) horizontal separation for 36- and 30-inch nominal diameter Water Supply and Return Flow Pipelines, respectively, made of Ductile Iron Pipe (DIP).

c) Horizontal separations narrower than 8-feet center-to-center will require engineering justification, such as site constraints, existing utilities, navigable waters, and would need to be reviewed on a case-by-case basis. A horizontal separation as narrow as 3-feet clear would also require the bottom of the Water Supply Pipeline to be located 18-inches above the top of the Return Flow Pipeline, as per NR 811.74 (2) (a) 1.

4) **Discussion and Questions**
   a) WDNR has permitted treated wastewater effluent mains in the past. A recent project was permitted for the City of Viroqua.
   b) Classification of the Return Flow Pipeline as either a raw sewage force main or stormwater main would not change the funding classification.
   c) WDNR regulations regarding distribution systems require a minimum AWWA pipe pressure class of 150 for a minimum 100 psi working pressure, as per NR 811.69 (2). WDNR noted the pressure class is a factor of 1.5 times above the working pressure. The WDNR acknowledged their regulations do not specifically cover working pressures as high as anticipated for the Water Supply and Return Flow Pipelines. A follow-up meeting will be scheduled after the water supplier is selected to discuss pressure classes.

5) **Summary Wrap-Up and Action Items**
   a) The design will proceed per the items summarized in the previous sections.
   b) Key action items are summarized in the table on Page 1.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the minutes will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER
ALLIANCE

WDNR PIPELINE HORIZONTAL SEPARATION MEETING
SIGN-IN SHEET

October 17, 2017

No.	Name	Company	Initial
1	Ted Bluver	Greeley and Hansen	[redacted]
2	Chris DeSilva	Greeley and Hansen	[redacted]
3	Kevin Richardson	Kevin Richardson Consulting	[redacted]
4	Benjamin Callan	WDNR	[redacted]
5	Jeanne Cargill	WDNR	[redacted]
6	Christopher Fuchsteiner	WDNR	[redacted]
7	Francis Fuja	WDNR	[redacted]
8	Jason Knutson	WDNR	[redacted]
9	Florence Olson	WDNR	[redacted]
10	Shaili Pfeiffer	WDNR	[redacted]
11	Cathrine Wunderlich	WDNR	[redacted]
12	Larry Landsness	WDRR	[redacted]
	Norm Hahn	WDNR	[redacted]

AGENDA

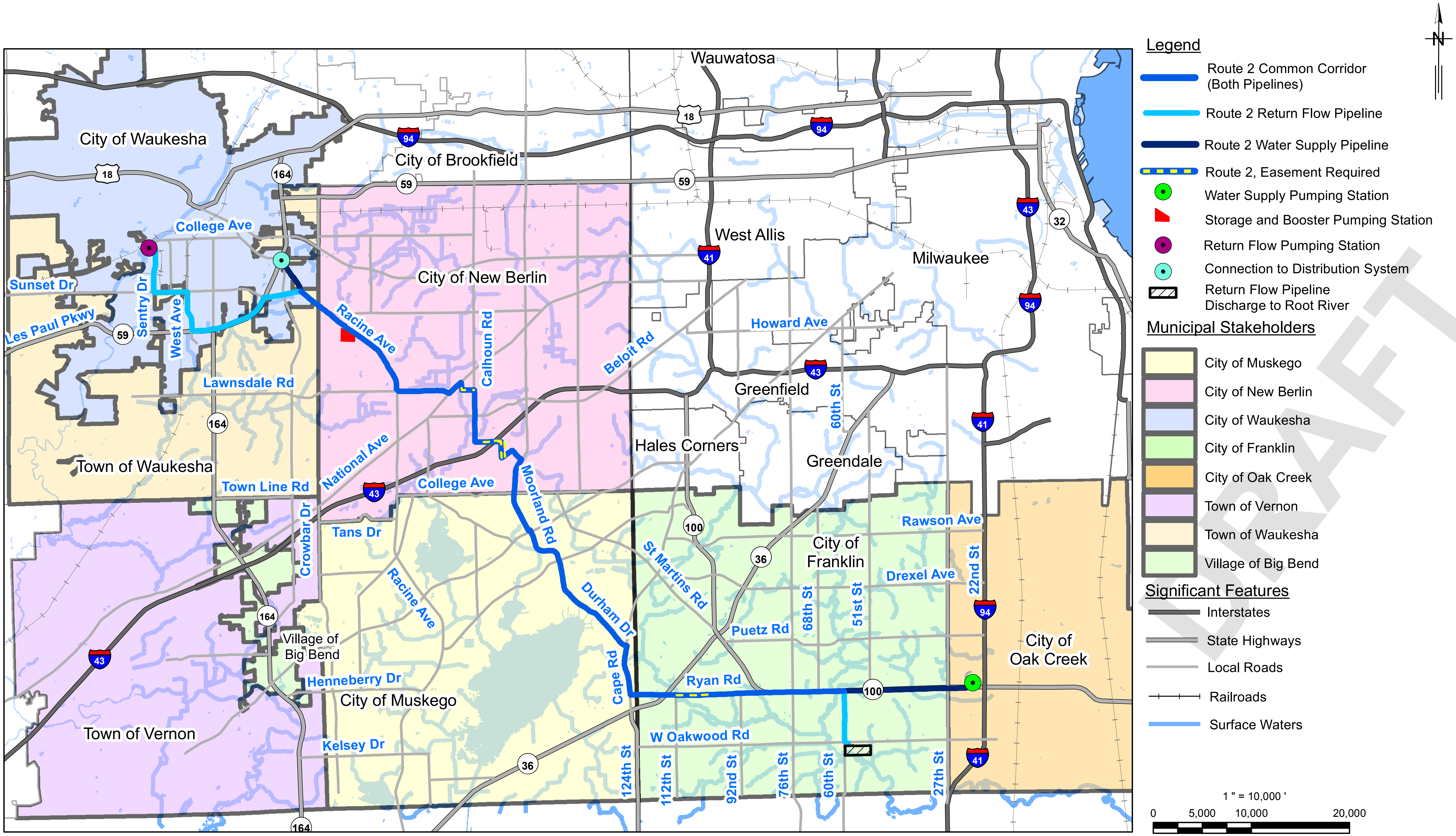
Date/Time: October 17, 2017, 3:00 p.m. – 4:30 p.m.

Location: WDNR Office Room No. 728, 101 S. Webster St, Madison, WI 53707

Attendees:

Ted Bluver, GH
Chris DeSilva, GH
Kevin Richardson, KRC
Benjamin Callan, WDNR
Jeanne Cargill, WDNR
Christopher Fuchsteiner, WDNR
Francis Fuja, WDNR
Jason Knutson, WDNR
Florence Olson, WDNR
Shaili Pfeiffer, WDNR
Cathrine Wunderlich, WDNR

Time	Topic	Presenter(s)
3:00 p.m.	Welcome - Introductions - Agenda Overview - Meeting Objectives ▪ Gain consensus on minimum horizontal separation distance allowed between Water Supply and Return Flow Pipelines	Ted Bluver
3:10 p.m.	Background - Pipelines Overview - Implications	Ted Bluver
3:30 p.m.	Review of Regulations - NR 811.74 - Other States	Ted Bluver
4:00 p.m.	Discussion and Questions - Has WDNR allowed exceptions to NR 811.74 in the past? - Has WDNR permitted a reclaimed water main?	All
4:20 p.m.	Summary Wrap-Up and Next Steps	Ted Bluver
4:30 p.m.	Adjourn	



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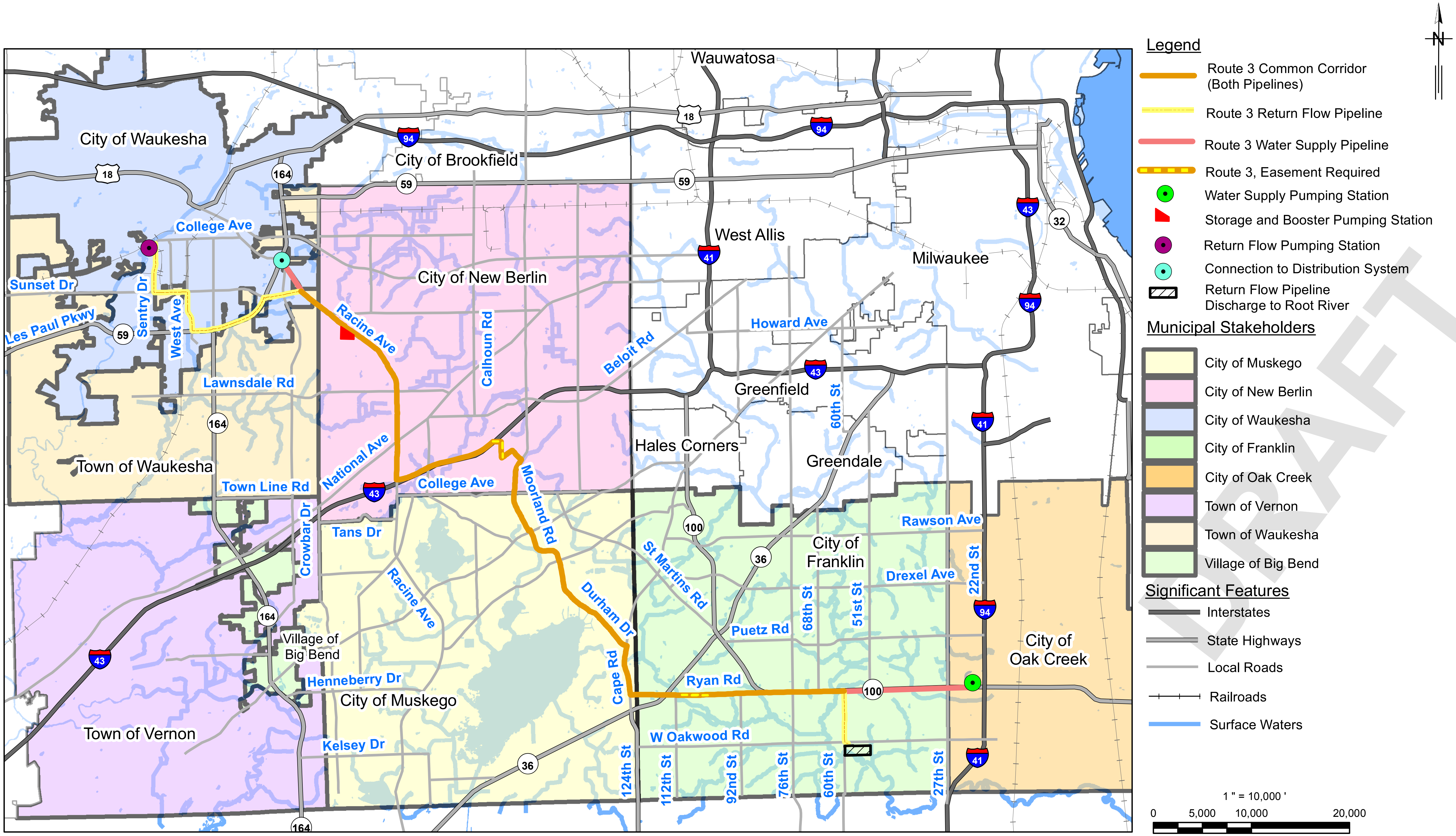
GREELEY AND HANSEN
741 N. Grand Avenue, Suite 308
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Route Alternative 2
Date: 10/9/2017

Plotted: 10/9/2017
Document Path: \\GH-DATA01\client02\15310-Waukesha Great Lakes Water Supply PM-CM24 GIS\24.01_Exhibits\Phase_2\Route Study\Aesthetics\Community Map\3Routes_EIS_10_04_17.mxd



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Document Path: \\GH-DATA01\client02\15310-Waukesha Great Lakes Water Supply PM-CM24 GIS\24.01_Exhibits\Phase_2\Route Study\Aesthetics\Community Map\3Routes_EIS_10_04_17.mxd

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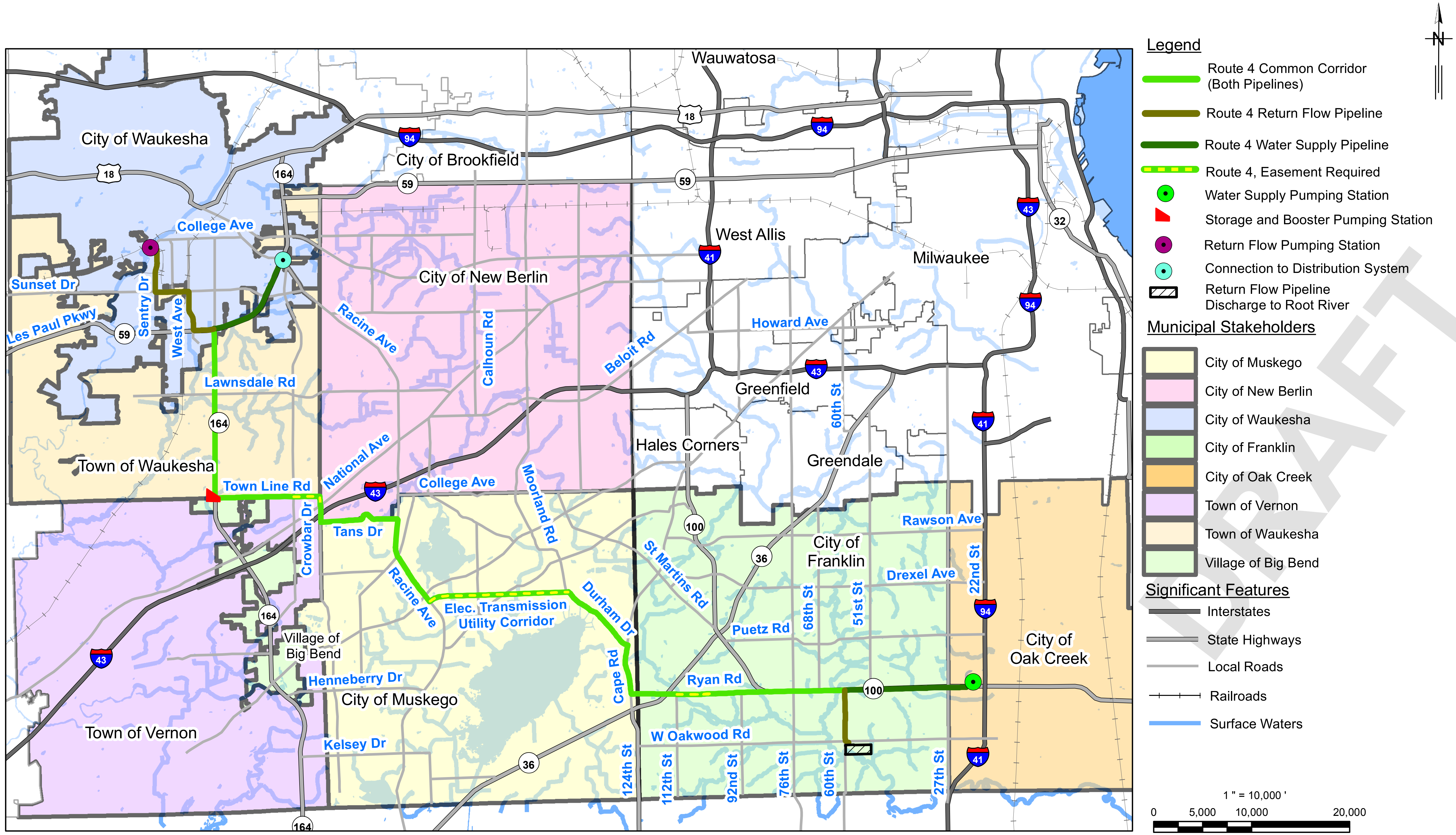
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Route Alternative 3
Date: 10/9/2017



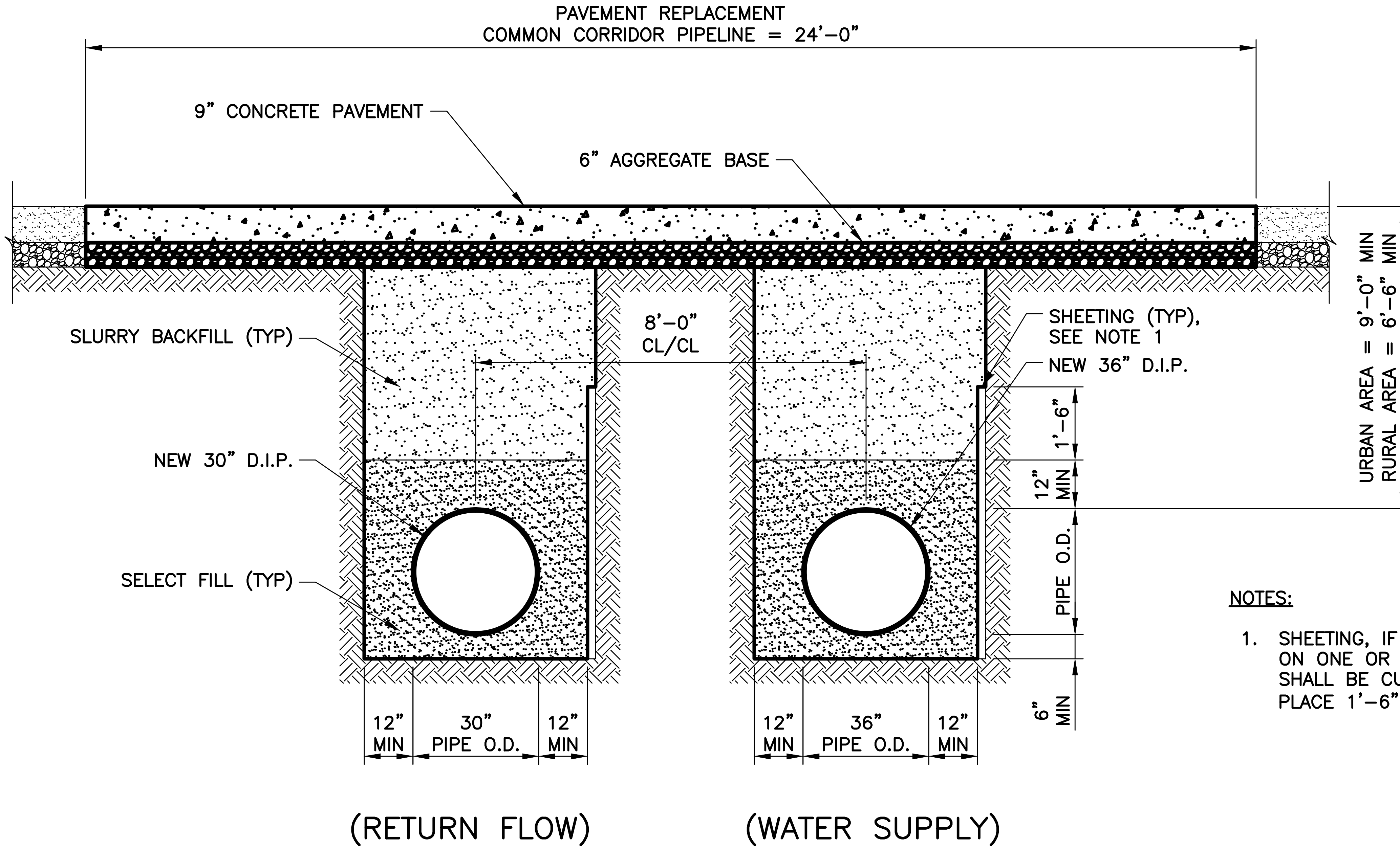
Plotted: 10/9/2017
Document Path: \\GH-DATA01\client02\15310-Waukesha Great Lakes Water Supply PM-CM24 GIS\24.01_Exhibits\Phase_2\Route Study\Aesthetics\Community Map\3Routes_EIS_10_04_17.mxd

GREAT WATER ALLIANCE™

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

GREELEY AND HANSEN
741 N. Grand Avenue, Suite 308
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Route Alternative 4
Date: 10/9/2017



NOTES:

1. SHEETING, IF USED OR REQUIRED ON ONE OR BOTH SIDES OF TRENCH SHALL BE CUTOFF AND LEFT IN PLACE 1'–6" ABOVE SELECT FILL.

COMMON CORRIDOR PIPELINE DETAIL

SCALE 3/8"= 1'–0"

WAUKESHA, WISCONSIN
GREAT LAKES WATER SUPPLY PROGRAM
WATER SUPPLY AND RETURN FLOW PIPELINES
TYPICAL DOUBLE PIPE TRENCH UNDER PAVEMENT DETAIL
09/08/2017

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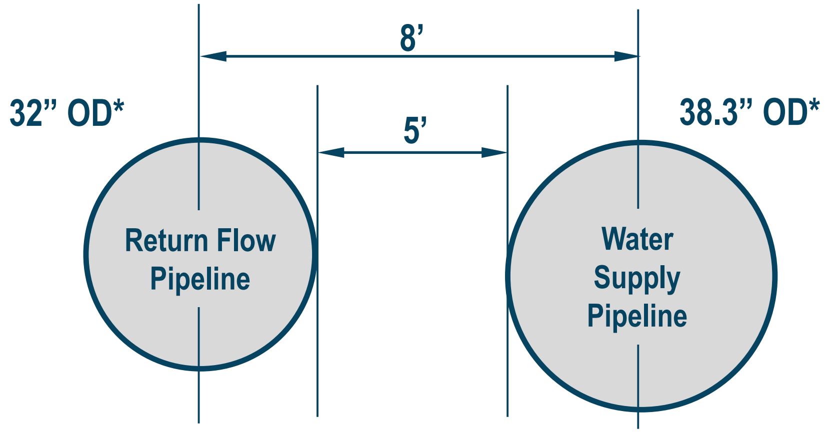
Review of Regulations: NR 811.74

NR 811 specifies 8-foot separation center-to-center



*Industry standard Outside Diameters (ODs) for Ductile Iron Pipe

NR 811.74 Separation of water mains and sanitary or storm sewer mains. (1) GENERAL. The following factors shall be considered in planning separation of water and sewer mains: materials and type of joints for water and sewer pipes, soil conditions, service and branch connections into the water main and sewer line, compensating variations in the horizontal and vertical separations, space for repair, and alterations of water and sewer pipes.

(2) HORIZONTAL SEPARATION. The following horizontal separation requirements shall be met:

(a) Water mains shall be laid at least 8 feet horizontally from any existing or proposed sanitary sewer main, storm sewer main, or sanitary or storm sewer manhole. The distance shall be measured center to center.

(b) In cases where it is not practical to maintain an 8–foot horizontal separation distance, the department may allow exceptions to that requirement on a case–by–case basis, if supported by data from the design engineer. The following requirements shall be met in order for the department to approve a center to center horizontal separation distance of less than 5 feet:

1. The bottom of the water main shall be at least 18 inches above the top of the sewer main and the minimum horizontal separation distance shall be 3 feet measured edge to edge.

2. A profile of the rock surface as determined from exploration shall be shown on the plan when high bedrock is the reason for the exception to the 8–foot separation distance.

Note: See Figure No. 10 in the Appendix.

(3) VERTICAL SEPARATION. If water mains cross over sanitary or storm sewer mains, the water main shall be laid at such an elevation that the bottom of the water main is at least 6 inches above the top of the sewer main. If water mains cross under sanitary or storm sewer mains, a minimum vertical separation distance of 18 inches shall be maintained between the top of the water main and the bottom of the sewer main. At crossings, one full length of water pipe shall be centered above or below the sewer so that both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required by the department after a determination that added support is necessary to meet the requirements of this chapter.

(4) EXCEPTION. If it is not possible to obtain the proper horizontal and vertical separation as specified in subs. (2) and (3), a gravity sanitary or storm sewer main shall be constructed of materials and with joints that are equivalent to water main standards of construction from manhole to manhole and air pressure tested to assure water tightness in accordance with the 4 psi pressure testing requirements given in s. NR 811.12 (5) (d) 2. Department approval is required for any exception to the requirements in subs. (2) and (3).

(5) FORCE MAINS. No exception to the 8–foot separation distance may be granted for sanitary sewer force main installations unless the requirement in sub. (2) (b) is met.

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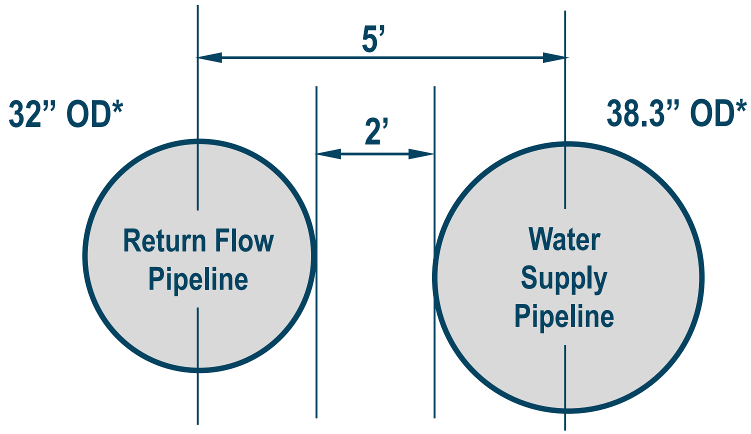
Review of Regulations: NR 811.74

NR 811 specifies exceptions to horizontal separation of distances between 8 and 5 feet with engineer justification (5 feet center-to-center is equivalent to 2 feet clear)



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(3) Vertical separation. If water mains cross over sanitary or storm sewer mains, the water main shall be laid at such an elevation that the bottom of the water main is at least 6 inches above the top of the sewer main. If water mains cross under sanitary or storm sewer mains, a minimum vertical separation distance of 18 inches shall be maintained between the top of the water main and the bottom of the sewer main. At crossings, one full length of water pipe shall be centered above or below the sewer so that both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required by the department after a determination that added support is necessary to meet the requirements of this chapter.

(4) Exception. If it is not possible to obtain the proper horizontal and vertical separation as specified in subs. (2) and (3), a gravity sanitary or storm sewer main shall be constructed of materials and with joints that are equivalent to water main standards of construction from manhole to manhole and air pressure tested to assure water tightness in accordance with the 4 psi pressure testing requirements given in s. NR 811.12 (5) (d) 2. Department approval is required for any exception to the requirements in subs. (2) and (3).

(5) Force mains. No exception to the 8−foot separation distance may be granted for sanitary sewer force main installations unless the requirement in sub. (2) (b) is met.

Review of Regulations: NR 811.74

NR 811 allows exception of less than 5-foot separation center-to-center, but requires shallow bedrock

NR 811.74 Separation of water mains and sanitary or storm sewer mains. (1) GENERAL. The following factors shall be considered in planning separation of water and sewer mains: materials and type of joints for water and sewer pipes, soil conditions, service and branch connections into the water main and sewer line, compensating variations in the horizontal and vertical separations, space for repair, and alterations of water and sewer pipes.

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(5) FORCE MAINS. No exception to the 8–foot separation distance may be granted for sanitary sewer force main installations unless the requirement in sub. (2) (b) is met.

Exceptions allowed for gravity sanitary or storm sewer main if constructed of materials and with joints equivalent to water main

Waukesha Water Utility

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Review of Regulations: NR 811.74

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No exceptions allowed for force mains unless (2) (b) is satisfied

Waukesha Water Utility

GREELEY AND HANSEN

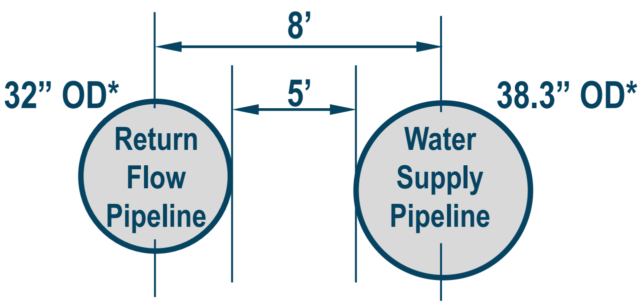
Review of Regulations: NR 811.74

- Return Flow is:
  - Highly treated
  - Highly tested and monitored
  - Approved for discharge to a water body used for potable water supply
  - Comparable quality to flow through storm water or reclaimed water main

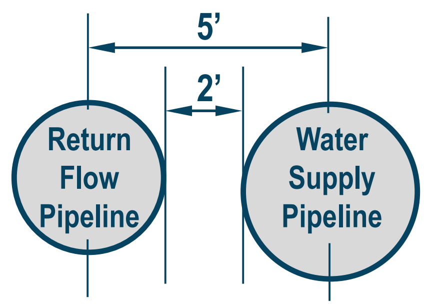
- Should the Return Flow Pipeline be classified as a sanitary force main or storm water force main?

Review of Regulations: Other States

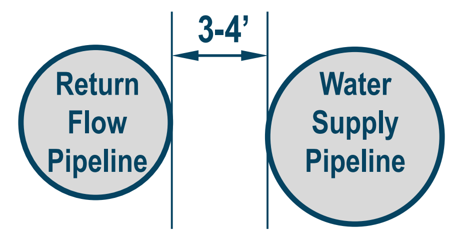
NR 811.74
Force Main – Water Main



NR 811.74
Gravity Sewer / Storm Main – Water Main



Other States
Reclaimed / Storm Main – Water Main



***Industry standard Outside Diameters (ODs) for Ductile Iron Pipe**

Other States’ regulations allow a minimum of 3-4 feet clear between water mains and storm water or reclaimed water mains

SUMMARY

The Great Lakes Water Supply Program Distribution System connection meeting was held at the Waukesha Water Utility (WWU) large conference room at 1:00 p.m. on September 27, 2017. The purpose of the meeting was to gain consensus on connection location alternatives and operational strategies to be used for distribution system modeling to accommodate the new water supply.

The attendees are listed on the attached sign-in sheet. The agenda, sign-in sheet, and connection point and configuration hand-outs are attached. The actions items are summarized in the table below.

Action Item		Action By	Due Date
1.	Review good GIS update protocol with Nick (WWU GIS Tech)	J. Henke, M. Bender	Before next GIS pipe update
2.	Run 16 model scenarios and recommend a connection alternative	J. Henke, M. Bender, T. Bluver	10/13/2017

Welcome

a) Meeting objectives were discussed.

1) Review Model Update Summary

a) Jennifer Henke reviewed the process for updating the model from the GIS, and how issues were created by the way the GIS has been updated in the past resulting in duplicate pipe IDs (AssetID field) that cannot directly be imported into the model. Kelly Zylstra mentioned that she would like CH2M to discuss with Nick (WWU GIS tech) the best method for future updates to the GIS so the process of updating the InfoWater model is more streamlined in the future. Kelly also mentioned that she anticipates an annual GIS update with newly added and removed pipes.

2) Review Field Testing Data

a) Jennifer reviewed the field pressure and flow testing completed by CH2M to use for calibrating the InfoWater hydraulic model of the distribution system.

b) Jennifer reviewed the results to date and went over the trends in the pressure monitoring data and how to interpret that for each zone of the system.

3) Review Steady State Calibration

a) Jennifer Henke reviewed the steady state calibration that had been done, and that potentially closed valves or the use of check valves could be the reason for the 2 locations where the pressure drop was more than 10 psi different between the model and the monitors.

4) Review Extended Period Simulation Calibration

a) Jennifer Henke went over the extended period simulation (EPS) calibration efforts and also reviewed what the purpose of EPS calibration is. She reviewed the results CH2M has to date with the model and how the model has been adjusted to match the monitored data. She mentioned further work needs to be done using the diurnal demand curves, and that it is possible to attempt to optimize the system for future demand using a time of day (TOD) power demand curve to take into account better times for pumping to minimize operating costs due to power consumption.

b) Jennifer asked if there are any specific concerns WWU has about the system and the model and the calibration. Kelly responded that she had been told the model previously was not fully calibrated, and that she was glad it would be fully calibrated with this effort.

5) Review Preliminary Results for Connection Options for Existing Demands

a) Jennifer reviewed the existing demands and how these and future demands create the scenarios to be modeled. She also mentioned that the storage strategy will differ from how it exists currently due to taking the wells out of operation. This modified approach is important in the Central Zone where the majority of ground storage tanks exist, the equalization necessary for well operation is no longer needed so much more storage is available in that zone for the new water supply.

b) Jennifer reviewed the existing storage capacity of the system with the new water supply, discounting the bottom 6 feet of the ground storage tanks. CH2M had originally shown the available storage volumes without the Saylesville (Well 8) site in service. WWU staff noted that it would more likely be the East (Well 5) site that may not be in service due to the age of the facilities and the performance of Well 5. There is potential for East tank to be used as storage only, without an associated well supply in the future.

6) Review Spatial Distribution of Future Demands for Future Scenarios

a) Jennifer reviewed the system wide demands and how the future demand had been scaled evenly across the model with previous efforts. She asked if Kelly or John would prefer that we scale based on spatial knowledge of where development would or would not occur, and both Kelly and John agreed that it would make more sense to remove zones they knew were fully developed from future demand and only project existing demand forward at those locations. At the zones where development is likely to occur, the future demand will be scaled from existing only in those zones.

b) Kelly asked what kind of error would be introduced into the model by scaling equally across the entire system, and Jennifer responded that the impact would not be huge because the areas of the zones where development is not predicted to occur are small, and that it makes sense to attempt to only add more demand in areas that will most likely see more demand.

c) Kelly mentioned the zones that would likely not see any further development included Northeast Zone, Southeast Zone, South Central Zone, and Hillcrest Zone. Only Central Zone and Oakmont Zone are likely to see future development and demand, along with Pebble Valley.

d) Jennifer reviewed the 16 scenarios the model will be running in order to provide a recommended connection point, which included the 4 demand alternatives (Existing ADD, Existing MDD, Future ADD, Future MDD) for each of the four connection alternatives.

e) Jennifer reviewed the assumptions that will be used for the 16 scenarios, including the assumption of either constant supply from the booster pump station, or variable supply using more storage at the booster pump station would be used to determine the most cost-effective method for operation with current conditions and future. Kelly asked if we could use the model to determine the required size of the pumps at the booster pump station, and Jennifer responded that the model could help determine the required size. She also mentioned the model would help determine phasing of improvements required to help keep capital costs reasonable.

7) Summary Wrap Up and Action Items

   a. Jennifer reviewed the next steps necessary to complete the calibration and choose a connection point for the new water supply, which include finalizing a connection scenario and to provide a recommendation to WWU on which scenario that will be.

   b. A meeting was agreed upon to make that decision on October 13, 2017 in the afternoon.

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Meeting Adjourned at 3:00 pm.

SUMMARY

The Great Lakes Water Supply Program Distribution System connection meeting was held at the Waukesha Water Utility (WWU) large conference room at 1:00 p.m. on October 13, 2017. The purpose of the meeting was to gain consensus on connection location alternatives and operational strategies to be used for distribution system modeling to accommodate the new water supply.

The attendees are listed on the attached sign-in sheet. The agenda, sign-in sheet, and hand-outs are attached. The actions items are summarized in the table below.

	Action Item	Action By	Due Date
1.	Get Waukesha CIP projects to the modeling team	K. Zylstra	10/20/2017
2.	Determine if CIP Project in Main Street Affects required 16-inch improvement in Arcadian Street	J. Henke/M. Bender	11/17/2017
3.	Determine controls and operation near the hospital in Central/Northwest zone.	K. Zylstra.	10/20/2017
4.	Run model scenario where Hillcrest Tank is taken out of the system.	J. Henke/M. Bender	11/10/2017
5.	Complete Calibration documentation	J. Henke, M. Bender	11/17/2017
6.	Complete Alternative Evaluation documentation	J. Henke, M. Bender	11/17/2017

Welcome

a) Meeting objectives were discussed.

1) Review Model Scenarios Summary

a) Jennifer reviewed the model scenarios ran and mentioned the process of using 6 continuous high demand days to ensure the system can recover from multiple days of high demand. She reviewed the scenarios were developed to assess connection points, identify improvements to support each connection alternative, and to identify operational protocol for future system operation.

b) She emphasized that facilities were sized to meet future MDD conditions, and that operations were verified for other demand scenarios. She also emphasized that new infrastructure was not required immediately, and that it could be phased when it is needed to manage capital expenditures.

c) Jennifer reviewed the system operation goals, which included using ground storage to meet peak hour demand. She mentioned that initially she thought the system would require two ground storage tanks (of either East, Saylesville or Sunset), but that the analysis had shown that only 1 would be required to meet

PHD. She mentioned that this approach optimizes the piping improvements necessary for supplying the northwest pressure zone and for refilling ground storage.

d) Jennifer reviewed the evaluation criteria,including maintaining pressures above 35 psi. She mentioned that the high elevations in the Central Zone proveed a challenge with the existing operating HGL in that zone. She went over the cause for low pressure areas, including elevation and high velocities and head loss. Part of the evaluation criteria was being able to fill tanks over a series of high demand days.

e) Jennifer reviewed the connection operational approach, including going over the differences between using Hunter Tower for operation and using a pressure setpoint for the booster pump station (BPS). She then summarized the scenarios again, and reviewed the four connection alternatives. She reviewed the storage strategy, and mentioned again that only 1 ground storage tank is needed to meet PHD.

f) The storage piping around all three of the available ground storage tanks (Saylesville, East, and Sunset) were reviewed to determine if upgrades around the tanks are necessary to be able to bypass the well source, but Kelly and John indicated that all three tanks have the ability to be backfilled from the system and have flow control valves so it wouldn't take a significant effort to get them online for the future water source. John did mentioned that Saylesville has larger pipes than the other 2 ground storage tanks.

2) Discuss Future ADD and MDD

a) Jennifer reviewed the ADD and MDD numbers reviewed for existing conditions and for future ultimate demand, and indicated that in the existing numbers, annexed areas were not taken into account for the modeling effort. It should be noted that if Waukesha plans to annex additional areas into their service area boundary, they may need to run additional model scenarios to determine if the system is adequate to serve future needs.

3) Review Scenario Results

a) Jennifer reviewed the scenario results, including how the pressures were assessed with no improvements other than connection piping to identify the best operational strategy and piping improvement combination that would maintain target pressures and meet tank operational goals. She indicated the piping improvements identified by the modeling were similar for all connection alternatives, since all connection alternatives were at large diameter pipelines in Les Paul.

b) She reviewed Connection 1 results where low pressures were observed in areas of high elevation in the Central Zone. She then reviewed connection 1 with recommended pipeline improvements and some slight zone re-alignment, which mitigated the low pressures observed in the 'no improvements' scenario.

c) Jennifer then reviewed all four connection alternative pipeline improvements, and went over the northwest/central zone realignment. Kelly noticed one improvement recommended for all scenarios is along Arcadian Ave, which could possibly be resolved through a CIP project already in the works. It was noted that there is a potential to build into Waukesha's CIP. Kelly asked if we could look at Main Street improvements and how they affect the 16-inch recommended on Arcadian, so she will provide a list of CIP improvements to include in the modeling effort.

d) The hospital area was indicated as a problem area with low pressures, and Kelly mentioned she would look into what is going on in that area. The age of pipes in the Central Zone was discussed, and Kelly mentioned the oldest pipes are all located in downtown Waukesha, but that pipes that were constructed in the 1960's are the pipes that break the most, and they are scattered throughout the system.

- e) Jennifer mentioned that raisin the HGL of Hillcrest tank up to 1,045 feet would result in increased pressures of 15 to 20 psi across the system and would allow for no additional piping imrpovements necessary. Kelly mentioned it made her anxious in terms of what it would take to implement, but that Hillcrest is the problem child of the system. John asked if there was a reason we couldn't take it out of commission since it causes problems and only has less than 1 MG of usable storage due to its HGL. It was agreed that the model would be re-run to see if the system could be operated without Hillcrest tank in service.
- f) Jennifer also reviewed the ADD operation of the system and he PRV setpoints for operation, and that they should be changed throughout the day to promote turnover (especially for lower demand days).
- g) John asked if dual pipelines were being run from Minooka BPS in any of the connection alternatives, and Ted re-iterated that no, none of the scenarios had a dual line running from the BPS to the connection point for redundancy.
- h) Kelly asked why previous reports had required so many more improvements for the system for future demand scenarios. Jennifer answered that those reports had used much higher numbers for future demand and therefore had required more improvements.

4) Review Comparison of Scenario Performance and Costs

- a) Jennifer reviewed the connection alternatives operation and went over the alternative cost comparison. Ted mentioned the Connection Alternative 1 was used as a baseline scenario, and so was given a value of $0, and all other scenario costs were compared to that baseline. Ted also mentioned that Connection alternative 3 should have $1M under system piping improvements cost since under that alternative, the line in Arcadian Ave was a 24-inch line rather than a 16-inch line.

5) Review Recommended Connection Point

- a) Jennifer reviewed that connection points 1 and 3 are very similar in cost and are the lowest cost options compared to alernatives 2 and 4. She mentioned that Connection Point 1 could also use the existing Highline Booster Pump Station site for the Water Supply Control Building.
- b) Ted recommended using Connection Point 1 as the chosen connection alternative. Kelly and John agreed.
- c) Jennifer re-iterated that pipeline improvements that were recommended weren't needed or triggered until the MDD increases above 12 MGD. Instantaneous flows higher than 12 mgd flows can be delivered, but once MDD reaches 12 or higher, the improvements would be necessary.

6) Summary Wrap Up and Action Items

- a) Jennifer reviewed the next steps, which include updating the alternative features from this meeting's discussion, incorporating recommended connection point into the PDR, and finalizing documentation for calibration and connection alternative evaluation. She also mentioned supporting IDSE evaluation and water quality evaluation.
- b) Jennifer summarized that the model scenario evaluation showed similar performance and improvement requirements across the 4 connection points, but that Connection 1 is the least cost alternative that makes use of existing property for new facilities.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

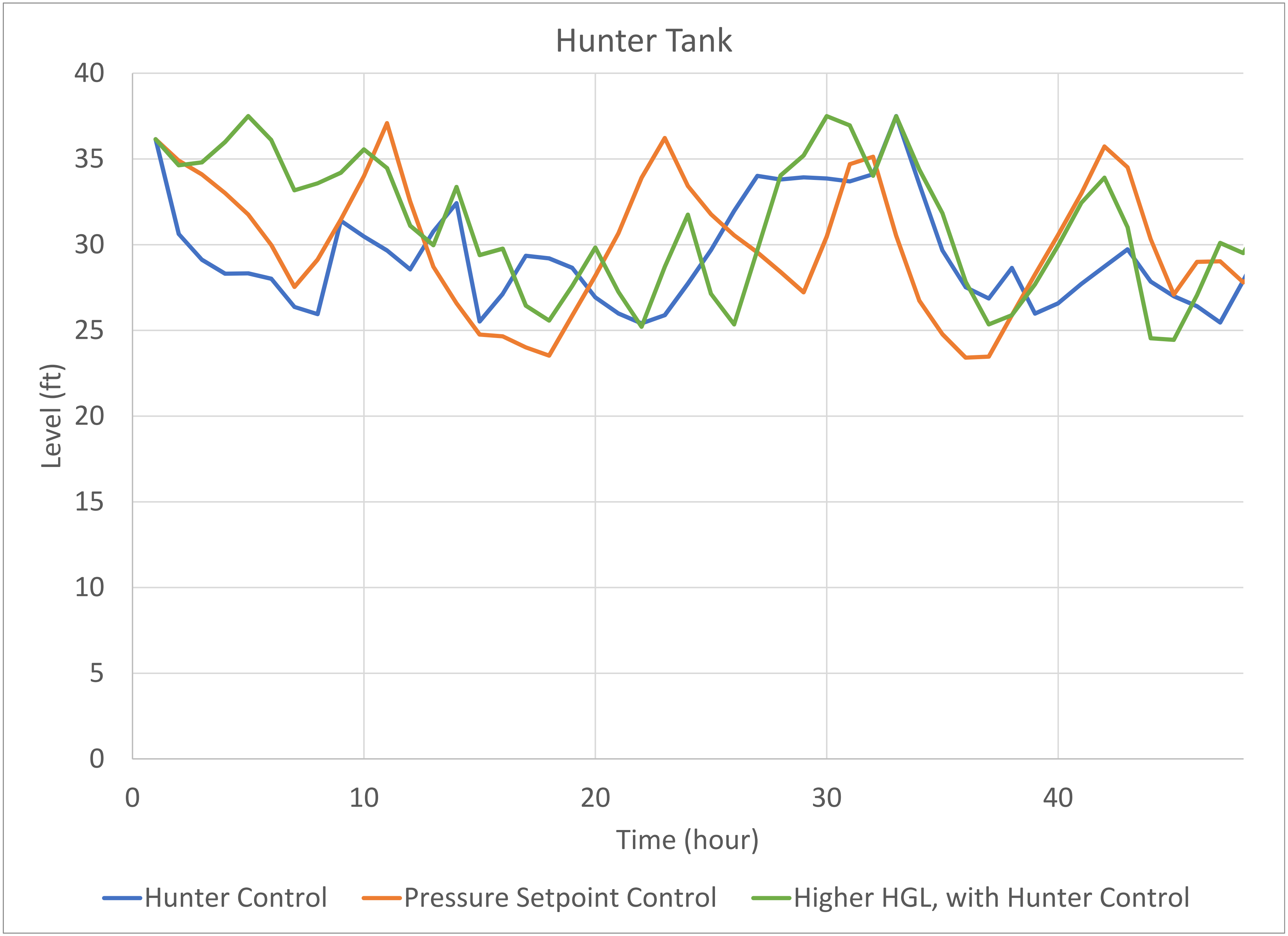
Date/Time: October 13, 2017, 1:00 p.m. – 3:00 p.m.

Location: WWU Conference Room

Attendees:

Kelly Zylstra, WWU
John Vick, WWU
Ted Bluver, Greeley and Hansen
Lee Melcher, Greeley and Hansen
Nicole Spieles, Greeley and Hansen
Katie Richardson, Greeley and Hansen
Mark Mittag, CH2M
Jennifer Henke, CH2M
Megan Bender, CH2M

Time	Topic	Presenter(s)
1:00 p.m.	Welcome – Meeting objectives	Jennifer Henke
1:05 p.m.	Review Model Scenarios Summary	Jennifer Henke
1:20 p.m.	Discuss Future ADD and MDD	Jennifer Henke/Megan Bender
1:35 p.m.	Review Scenario Results – 4 Connection Points – 4 Flow Regimes (Existing ADD and MDD, Future ADD and MDD) – Usage of Hunter Tower as control point	Jennifer Henke/Megan Bender
2:10 p.m.	Review Comparison of Scenario Performance and Costs	Jennifer Henke/Ted Bluver
2:30 p.m.	Review Recommended Connection Point – Gain consensus on Connection Point	Jennifer Henke
2:50 p.m.	Summary Wrap-up and Action Items	Jennifer Henke
3:00 p.m.	Adjourn	



Hunter Tank
40
35
30
25
20
15
10
5
0
Level (ft)
0
10
20
30
40
Time (hour)
Hunter Control
Pressure Setpoint Control
Higher HGL, with Hunter Control

Great Lakes Water Supply Program

Great Water Alliance | Meeting 5-100 M-05

Distribution System Hydraulic Model Connection Meeting

October 13, 2017

GREAT WATER ALLIANCE

GREELEY AND HANSEN

Meeting Agenda

- Review Model Scenarios Summary
- Discuss Future ADD and MDD
- Review Individual Scenario Results
- Compare Scenario Results and Costs
- Discuss Recommended Connection Point and Improvement Phasing
- Summary and Wrap Up

Meeting Objectives

- Discuss the future ADD and MDD
- Review scenario results with piping upgrades and system operation
- Confirm recommended connection point

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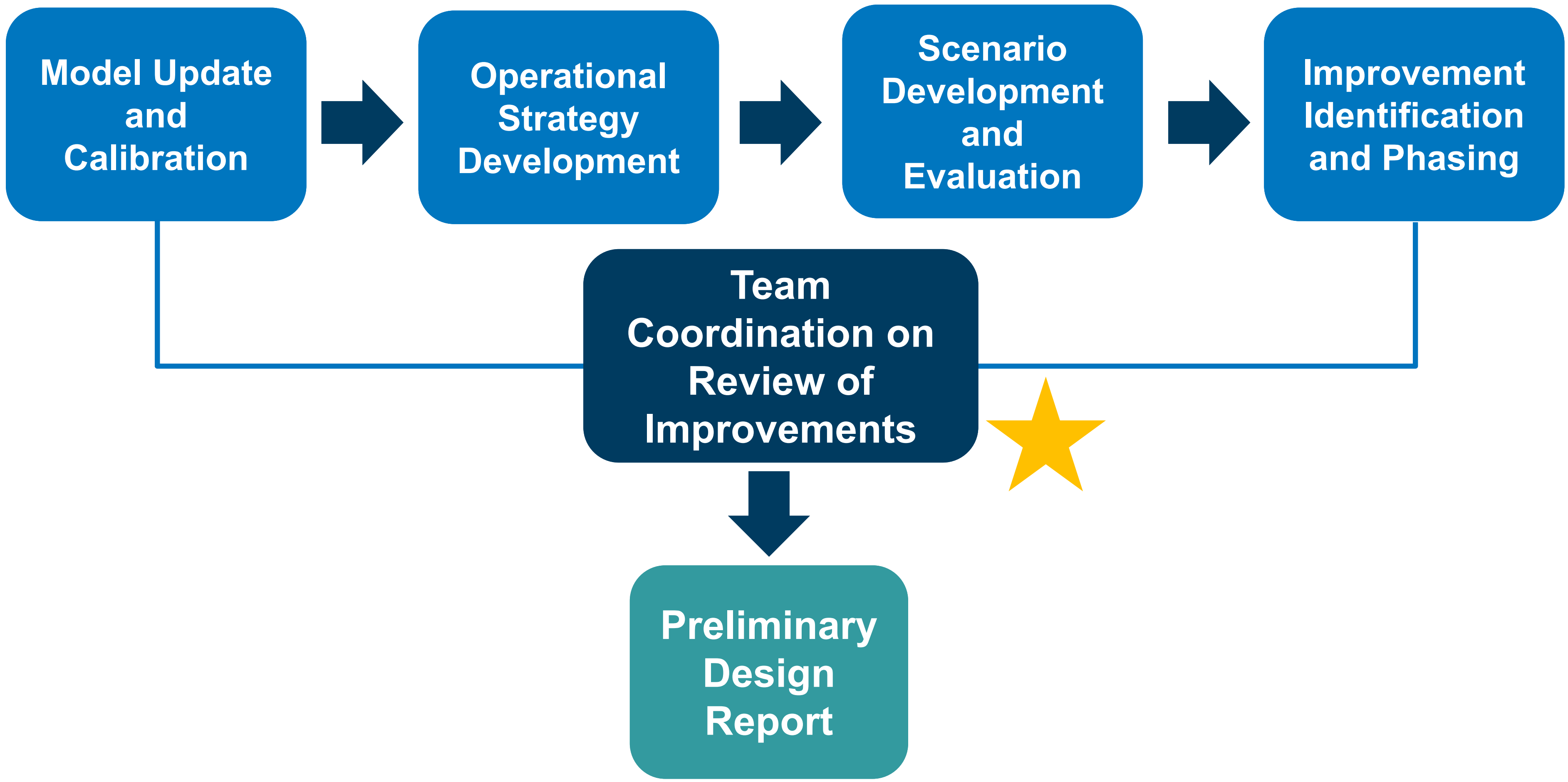
Workplan


Model Update and Calibration
Operational Strategy Development
Scenario Development and Evaluation
Improvement Identification and Phasing
Team Coordination on Review of Improvements
Preliminary Design Report

Review Model Scenarios Summary

Analysis Approach

- Scenarios developed to:
  - Assess connection points
  - Identify improvements to support each connection alternative
  - Identify operational protocol for future system operation
- Overall approach for utilizing storage and setting target supply rates developed *first* to define target operating schemes to size facilities
- Facilities sized to meet future MDD conditions and operations verified for other demand scenarios
- *New infrastructure to be phased when it is needed to manage capital expenditures*

System Operation

- System operation goals included using ground storage to meet peak hour demand
  - Pump from ground storage during peak hour
  - Fill ground storage during low demand
  - Use one GST to help support meeting PHD each day (rotate operation)
- This approach optimizes the piping improvements needed to transfer supply from east to west for supplying the Northwest Pressure Zone and for refilling of ground storage

Evaluation Criteria

- Maintain pressure above 35 psi
  - High elevation areas in Central Zone are a challenge with the existing operating HGL
- Assess cause in low pressure areas
  - Elevation
  - High velocity/headloss
    - Chronic
    - Result of operation
- Tank fill and draw
  - Must be able to refill tanks over a series of high demand days

Connection Operational Approach

- Developed control strategy for BPS and flow prediction for operating range
- BPS control methodology assessed the following options:
  – Hunter Tower
  – Upstream pressure set point at water supply control building
    - Water supply control building is anticipated to need telemetry to remotely change PRV setpoint as system demands change throughout the year

Connection Operational Approach: Hunter Tower and Pressure Setpoint

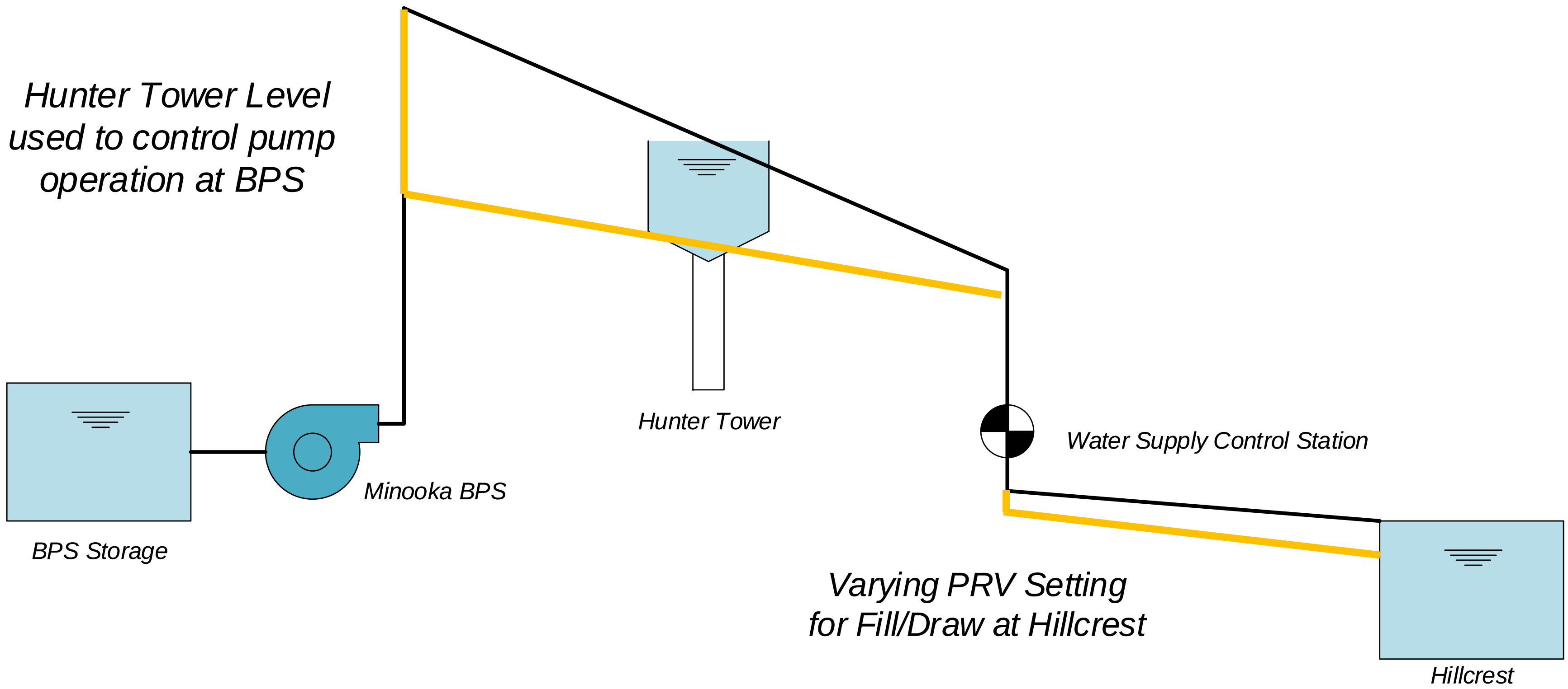
Hunter Tower Operation

- BPS is continually operated
- No pumping from Central to Southeast High Zone
- BPS provides supply to Southeast High and Southeast Reduced
- Baseline pump plus pump that is ramped up/down based upon Hunter Tower Level

Pressure Setpoint for BPS

- BPS is continually operated
- Pumping *(repumping)* from Central to Southeast High Zone
- Central Zone supplies Southeast High and Southeast Reduced
- Baseline pump plus pump that is ramped up/down based upon pressure setpoint

BPS and Supply Control Approach: Hunter Tower



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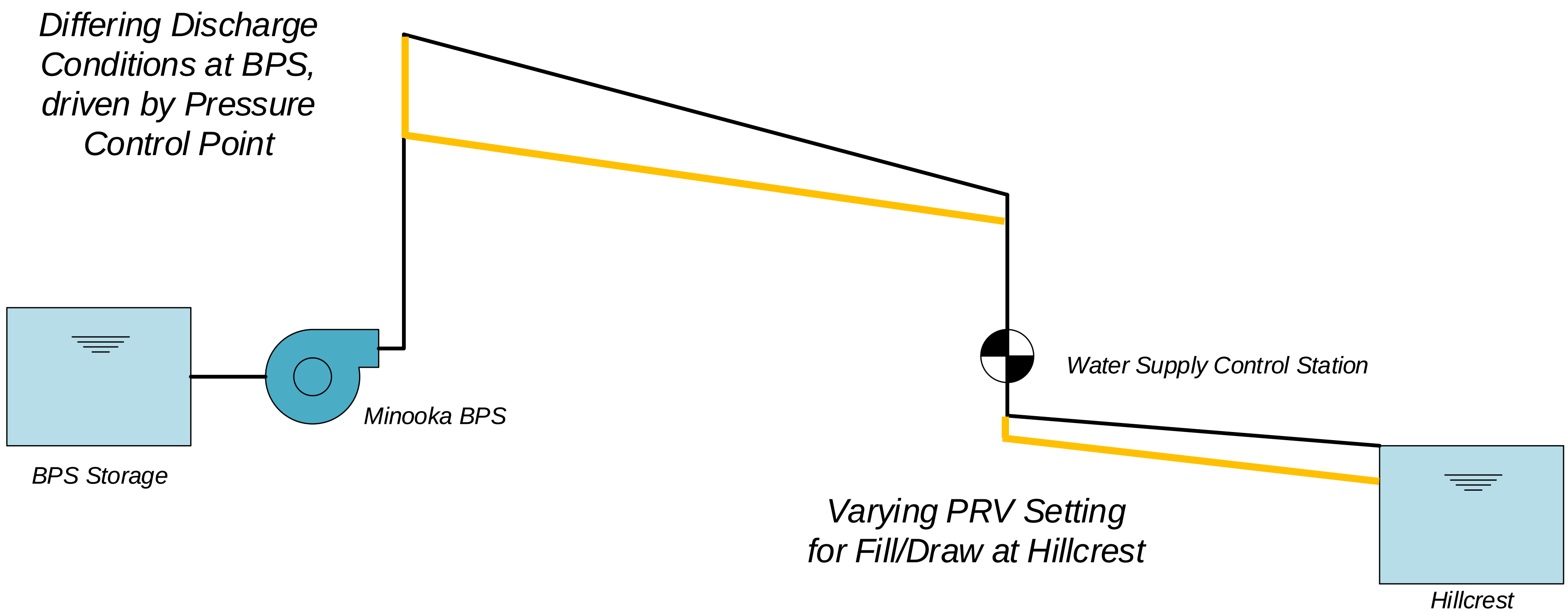
BPS and Supply Control Approach: Pressure Setpoint



Scenario Summary

Demand Condition	Connection Alternatives			
	1	2	3	4
Existing ADD	Supply = 6.0 mgd; Assess operations, review water age			
Existing MDD	Supply = 10.0 mgd; ***Phase identified improvements,*** assess operations			
Future ADD	Supply = 8.2 mgd; Assess operations, review water age			
Future MDD	Supply = 13.6 mgd; ***Identify improvements***, assess operations			

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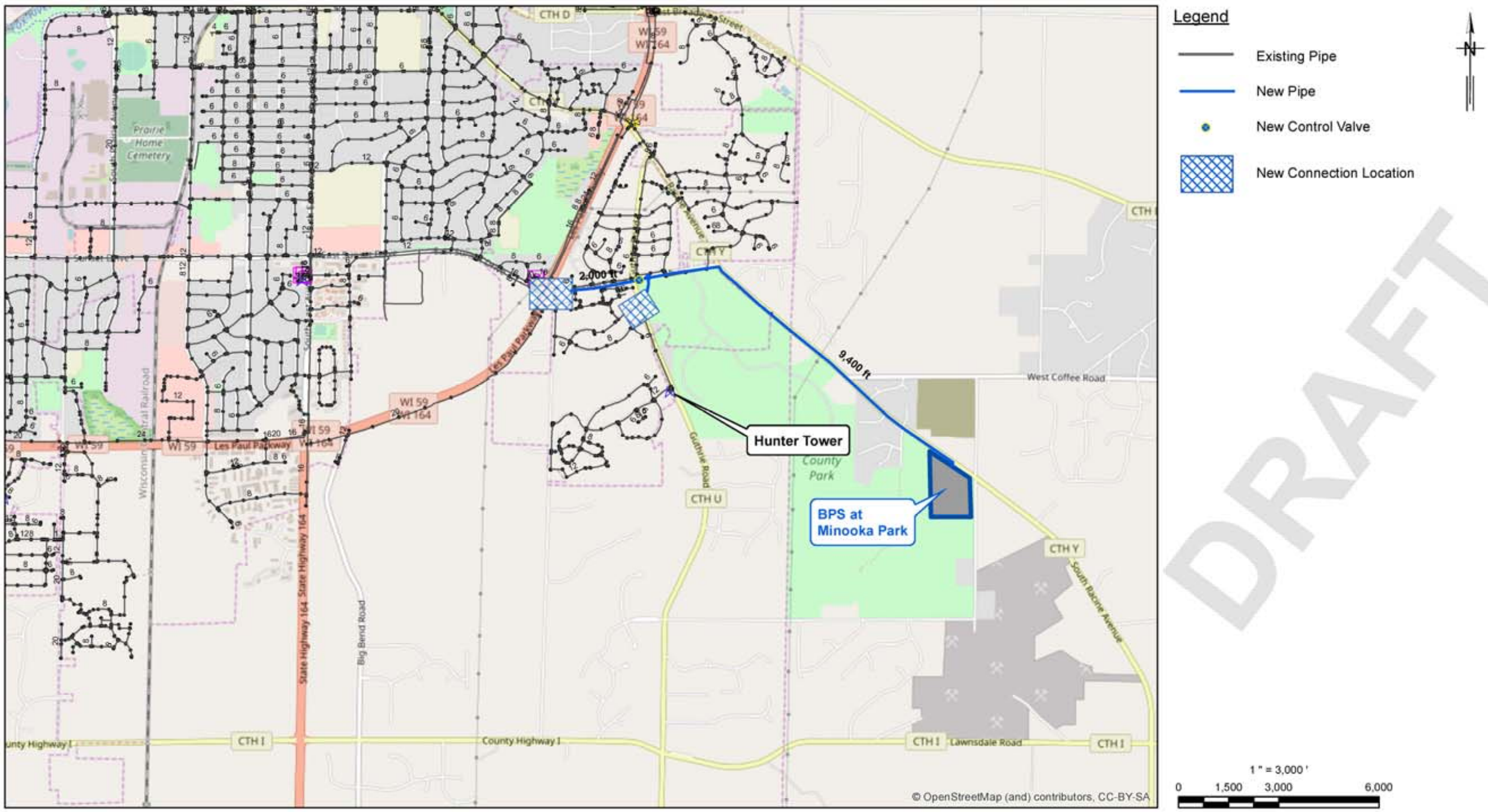
Connection Alternative 1



Plotted: 9/5/2017
Document Path: F:\Waukesha Connection Evaluations\11x17.mxd

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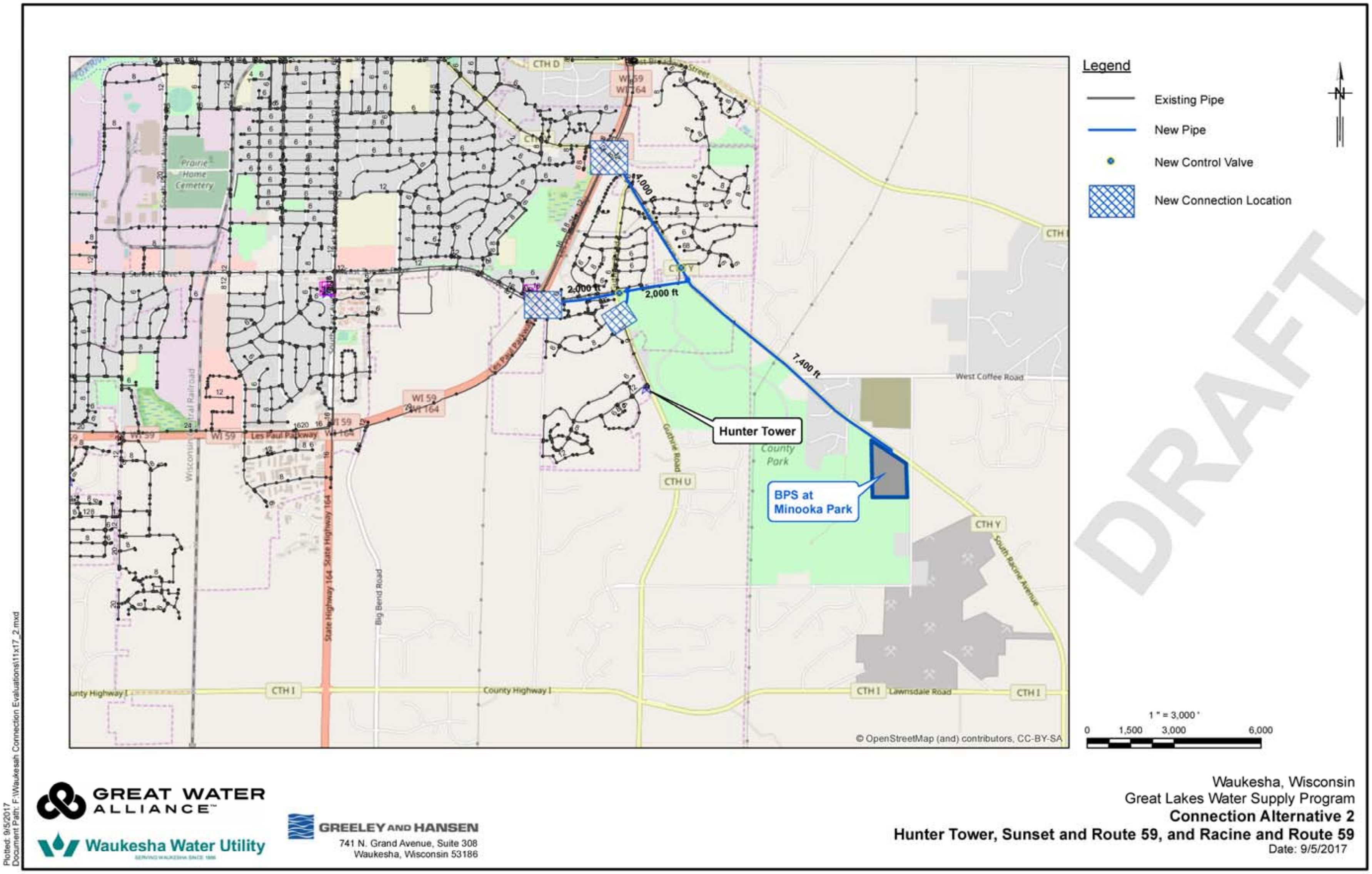
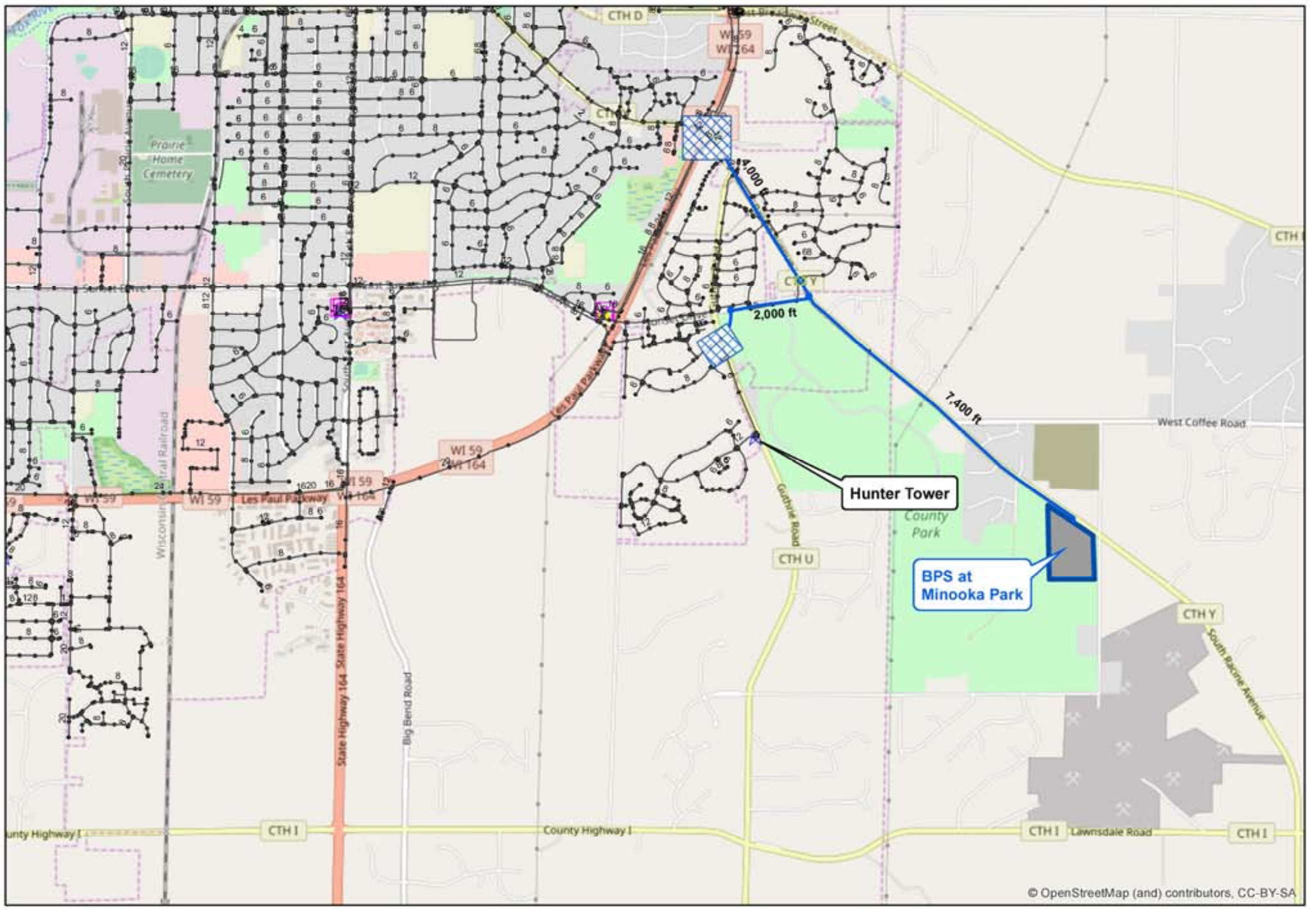
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Connection Alternative 1
Hunter Tower and Sunset and Route 59
Date: 9/5/2017

Connection Alternative 2



Connection Alternative 3



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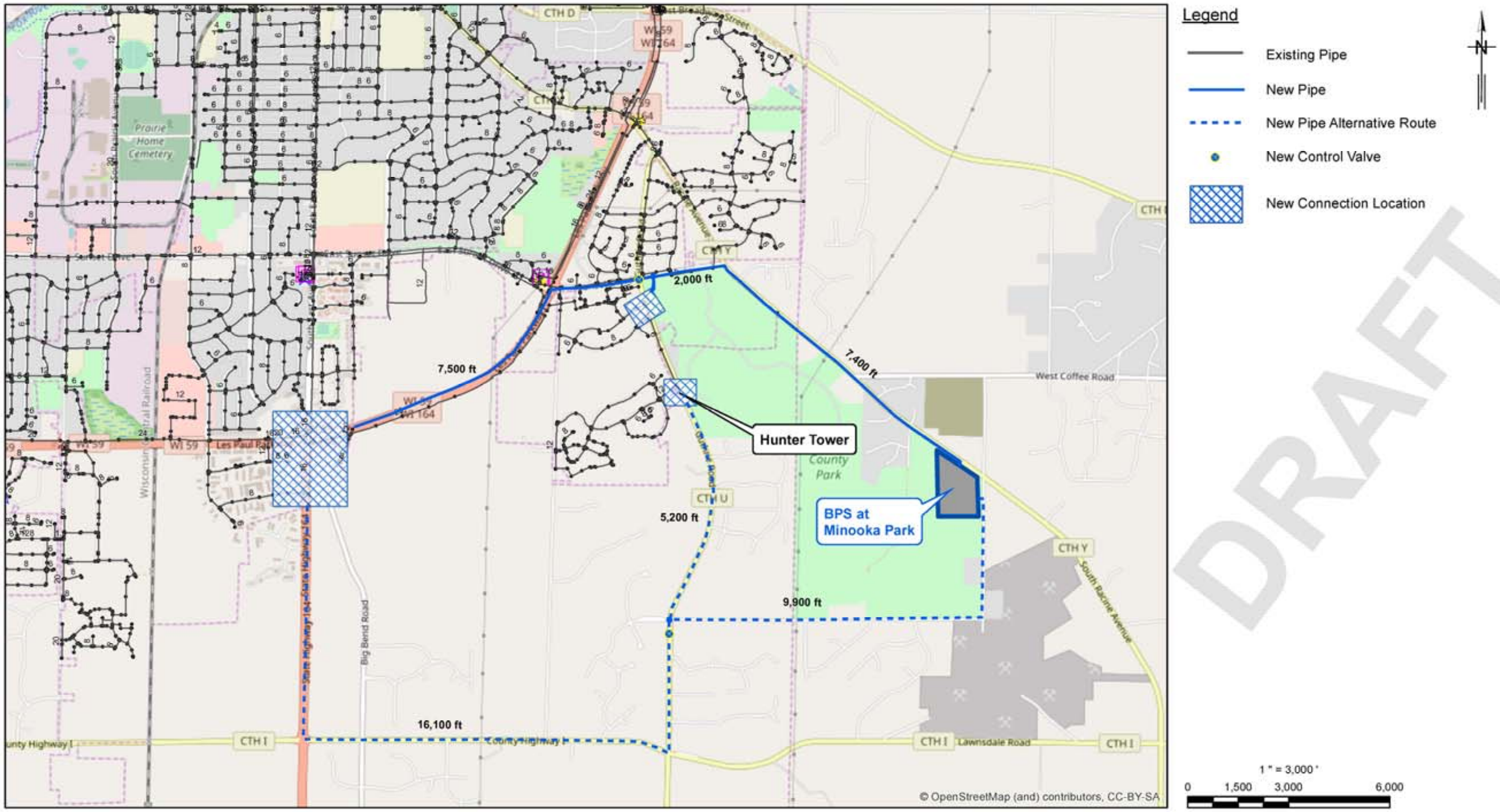
Waukesha, Wisconsin
Great Lakes Water Supply Program
Connection Alternative 3
Hunter Tower and Racine and Route 59
Date: 9/5/2017

Connection Alternative 4



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Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Connection Alternative 4
Hunter Tower and SR 164 and Route 59
Date: 9/5/2017

Plotted: 9/5/2017
Document Path: F:\Waukesah Connection Evaluations\11x17_4.mxd

Storage Strategy

Storage Category	Central Zone Storage (gal)	
	Existing	**Future**
Equalization Storage[1]	773,000	1,057,000
Operational Storage[2]	248,000	298,000
Emergency Storage[3]	630,000	630,000
Total Required	1,651,000	1,985,000
Total Available[4]	3,358,200	3,358,200

[1]Based upon Peak Hour Demand
[2]15% of Total Storage Required
[3]Fire Flow emergency volume only
[4]Total available storage is from Hillcrest (630,000 gal), Saylesville (1,575,000 gal), and Sunset (1,208,000 gal); Hillcrest available volume only includes fire flow volume; Saylesville and Sunset volume does not include bottom 6 feet; East (Well 5) could contribute another 1,153,000 gal.

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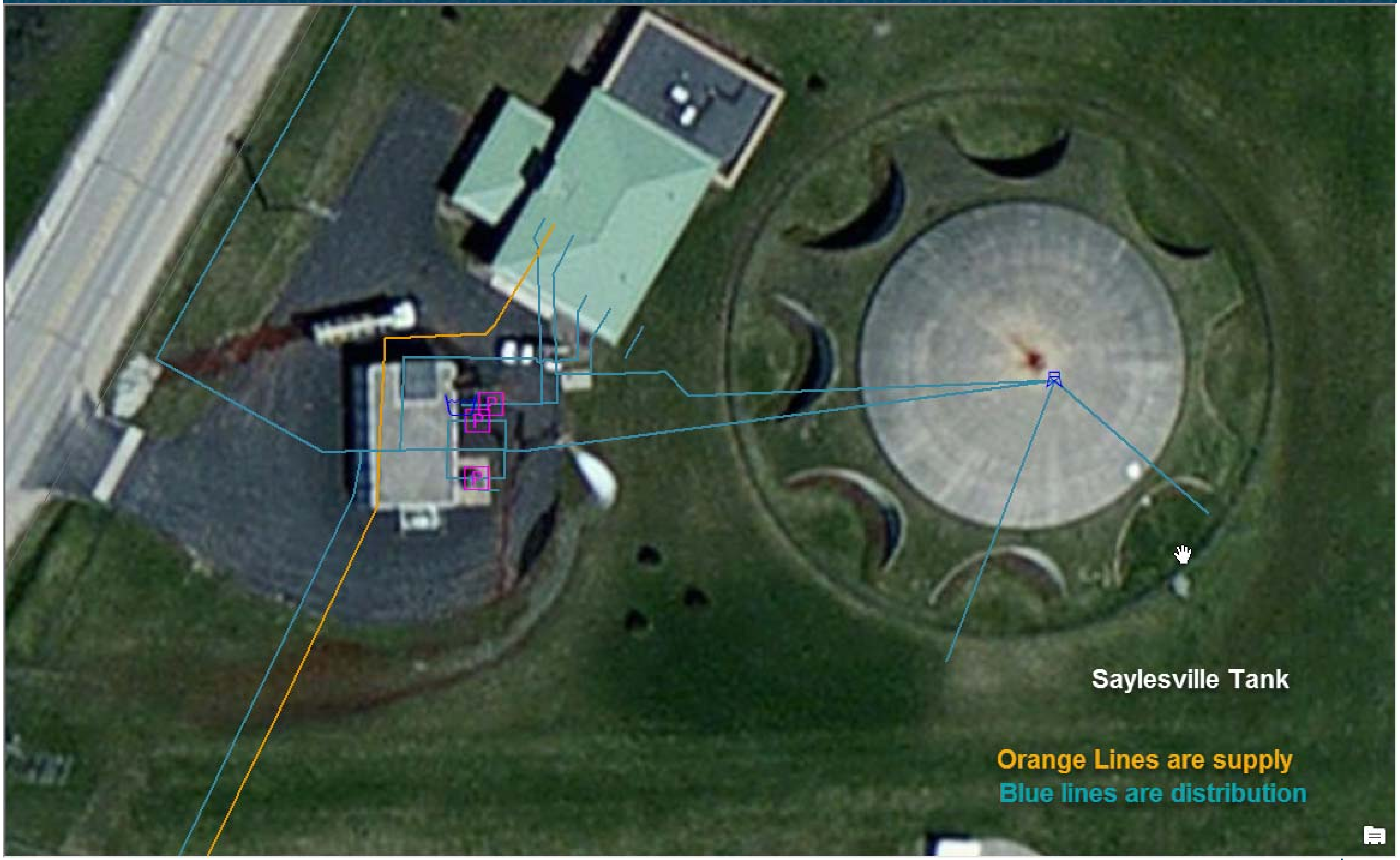
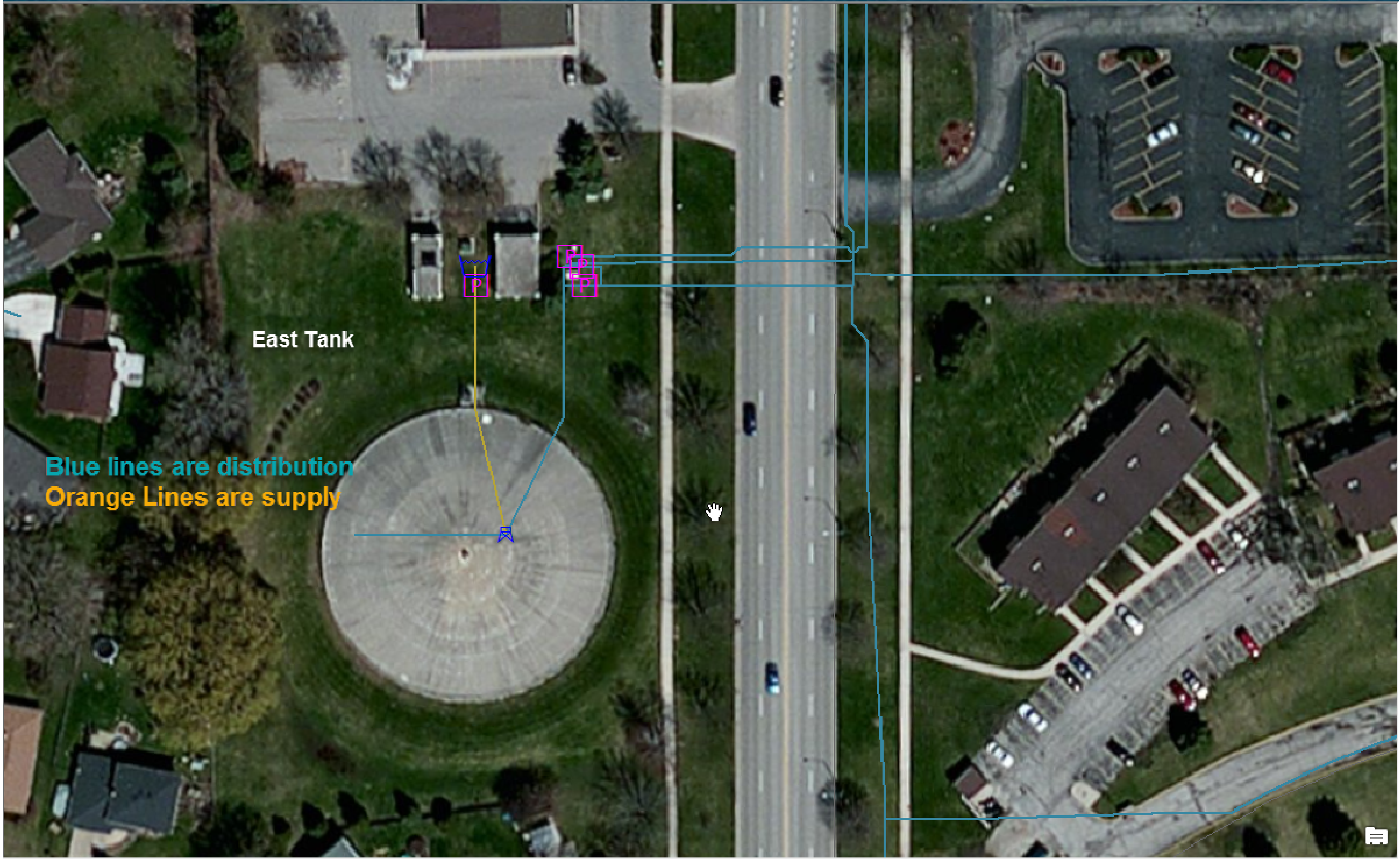
Storage Piping - Saylesville Tank



Storage Piping – East Tank



Storage Piping – Sunset Tank

Discuss Future ADD and MDD

System-wide Demand Summary

Time Period	Average Day Demand (mgd)	Maximum Day Demand (mgd)
Existing	6.6	10.8
Ultimate	8.2	13.6

- Projections are based upon approved demand scenarios, does not include potential for future annexation
- Existing demand allocation scaled proportionally based upon currently built out areas (no increase) and scaling remaining demand where additional growth could occur
- Modeling is demand driven and facilities are operated based upon the response to the demand

Review Individual Scenario Results

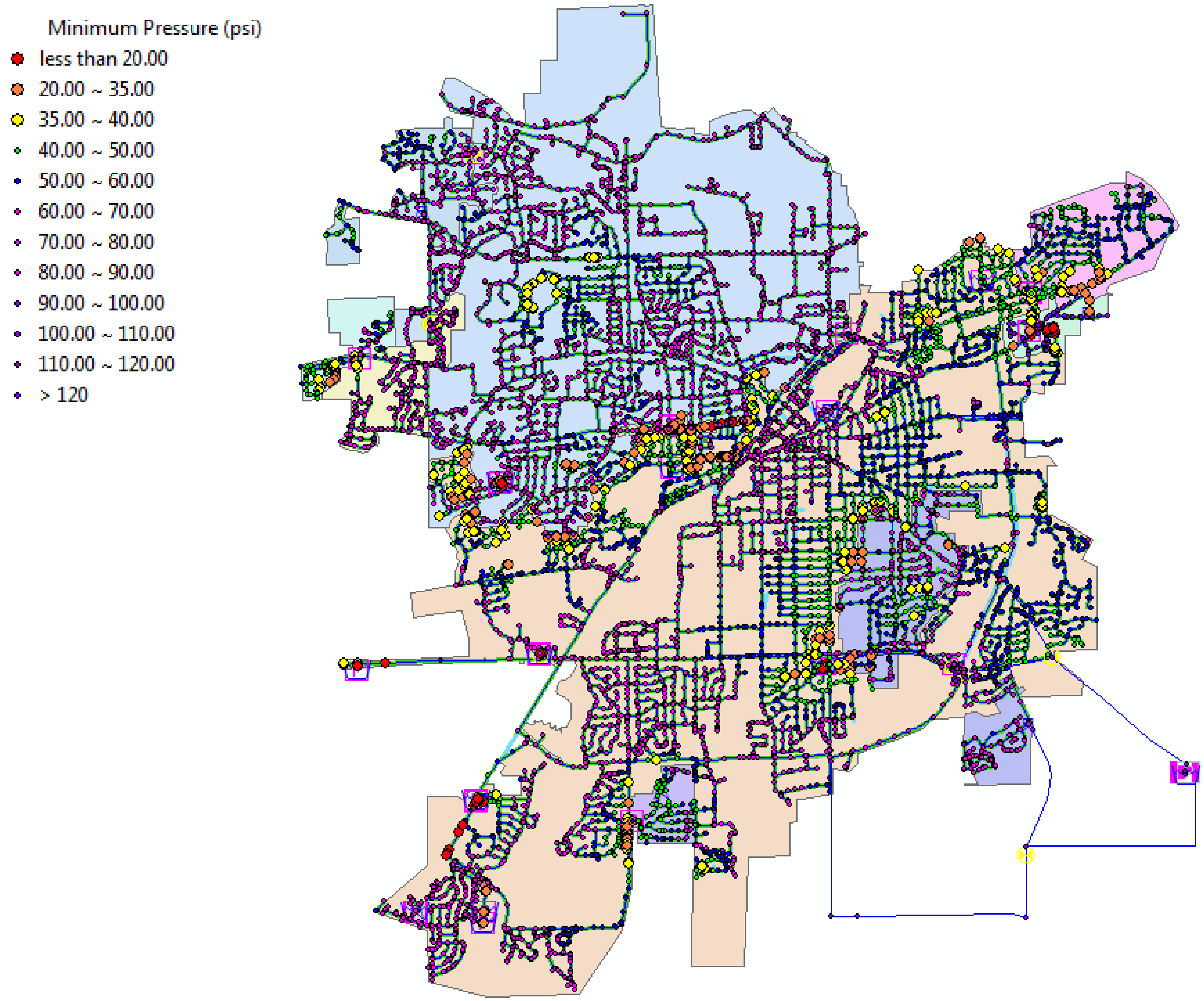
Scenario Strategy

- Assess pressures with no improvements other than connection piping
- Identify combination of operational strategy and piping improvements to maintain target pressures and meet tank operation goals
- Piping improvements are similar between connection alternatives due to connections all being along large diameter pipeline in Les Paul

Connection 1, No Improvements

- Low pressures observed
- High elevation areas of Central Zone

- Low pressures observed for all scenarios adjacent to tanks and on well supply piping to GSTs



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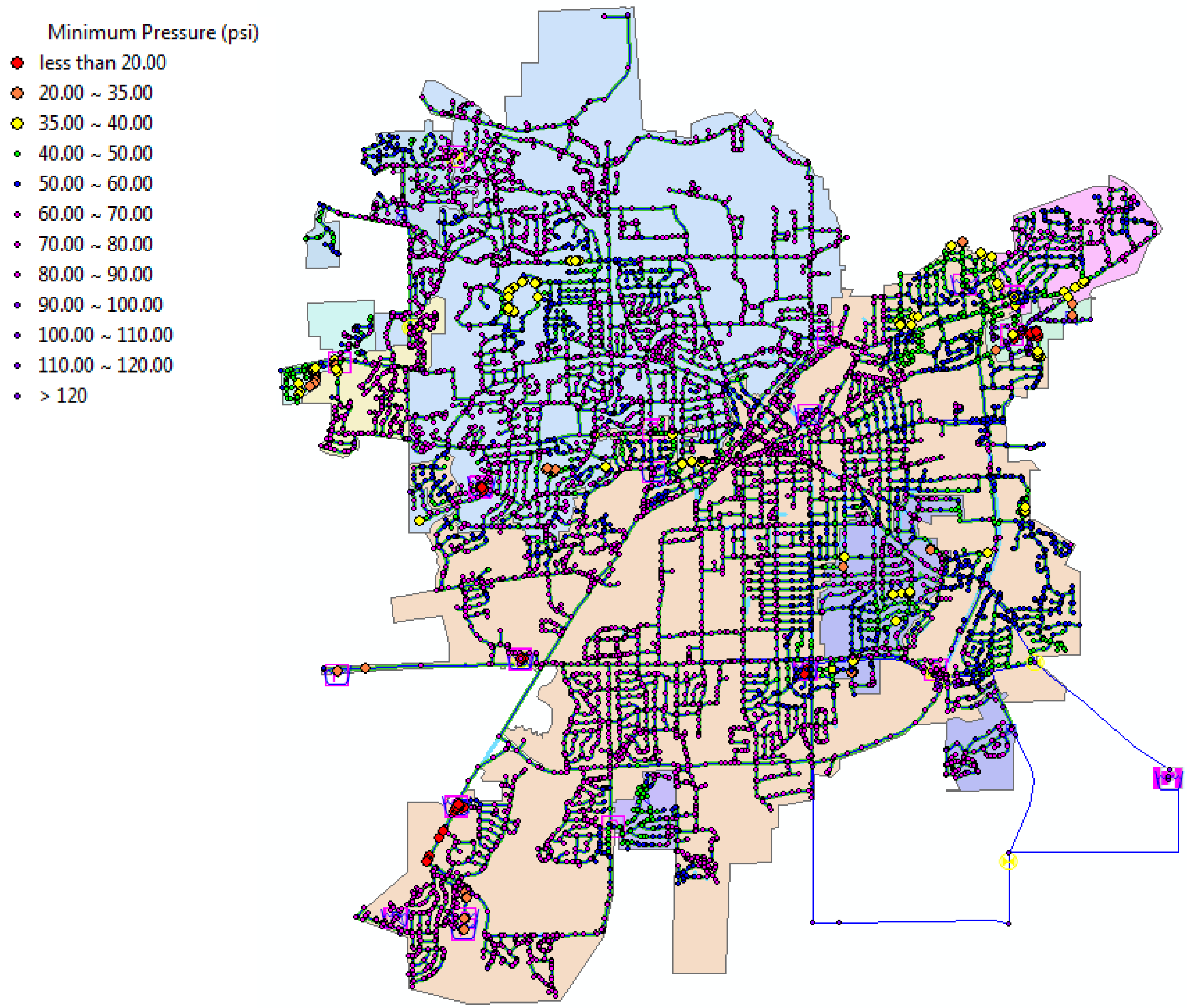
Connection 1, With Improvements

- Low pressure mitigated
- Improvements include
  - Piping
  - Slight zone realignment



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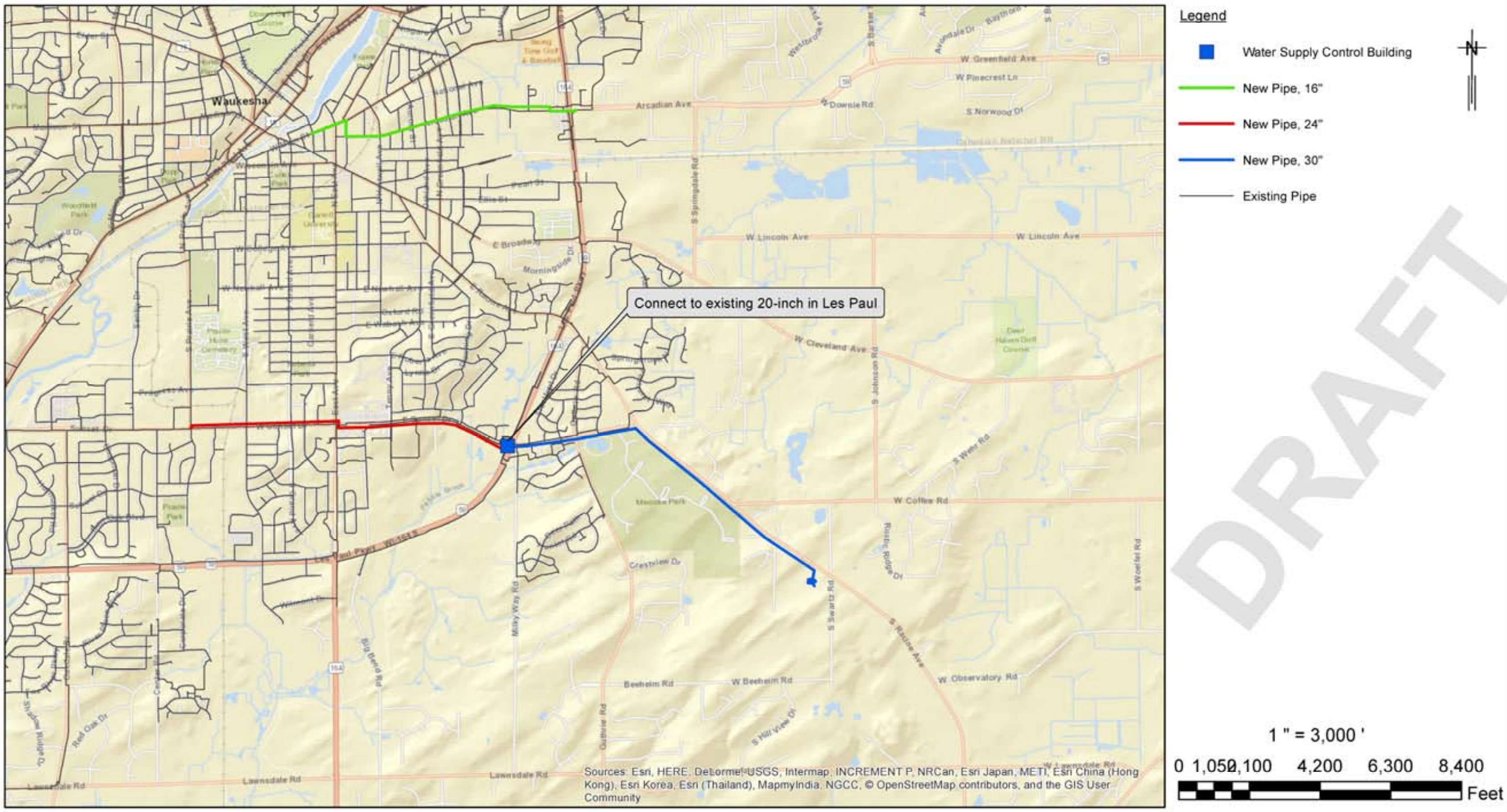
Connection 1, Pipeline Improvements



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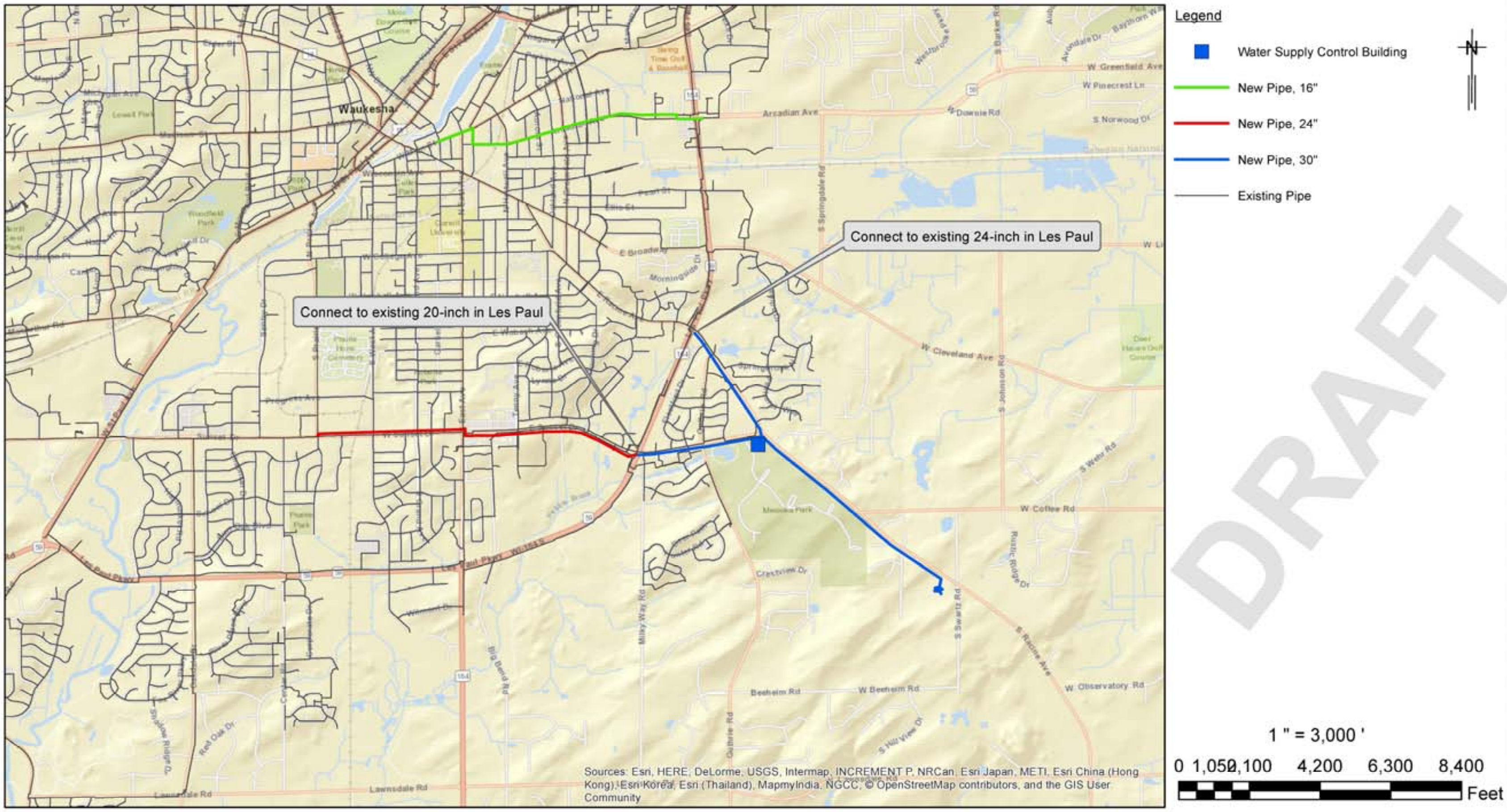
Great Lakes Water Supply Program
Connection Alternative 1
Hunter Tower and Sunset and Route 59
Date: 10/12/2017

Connection 2: Pipeline Improvements



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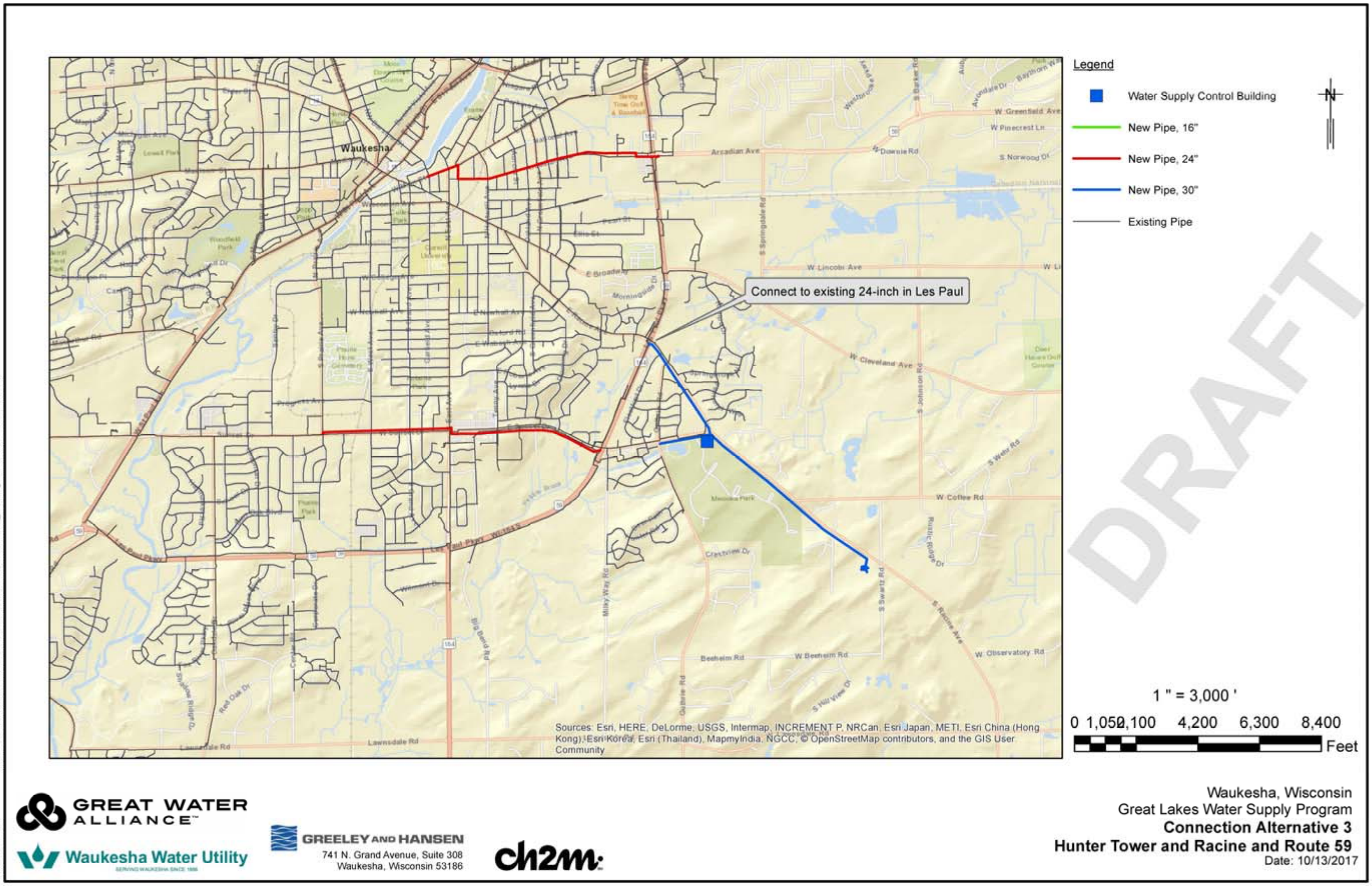
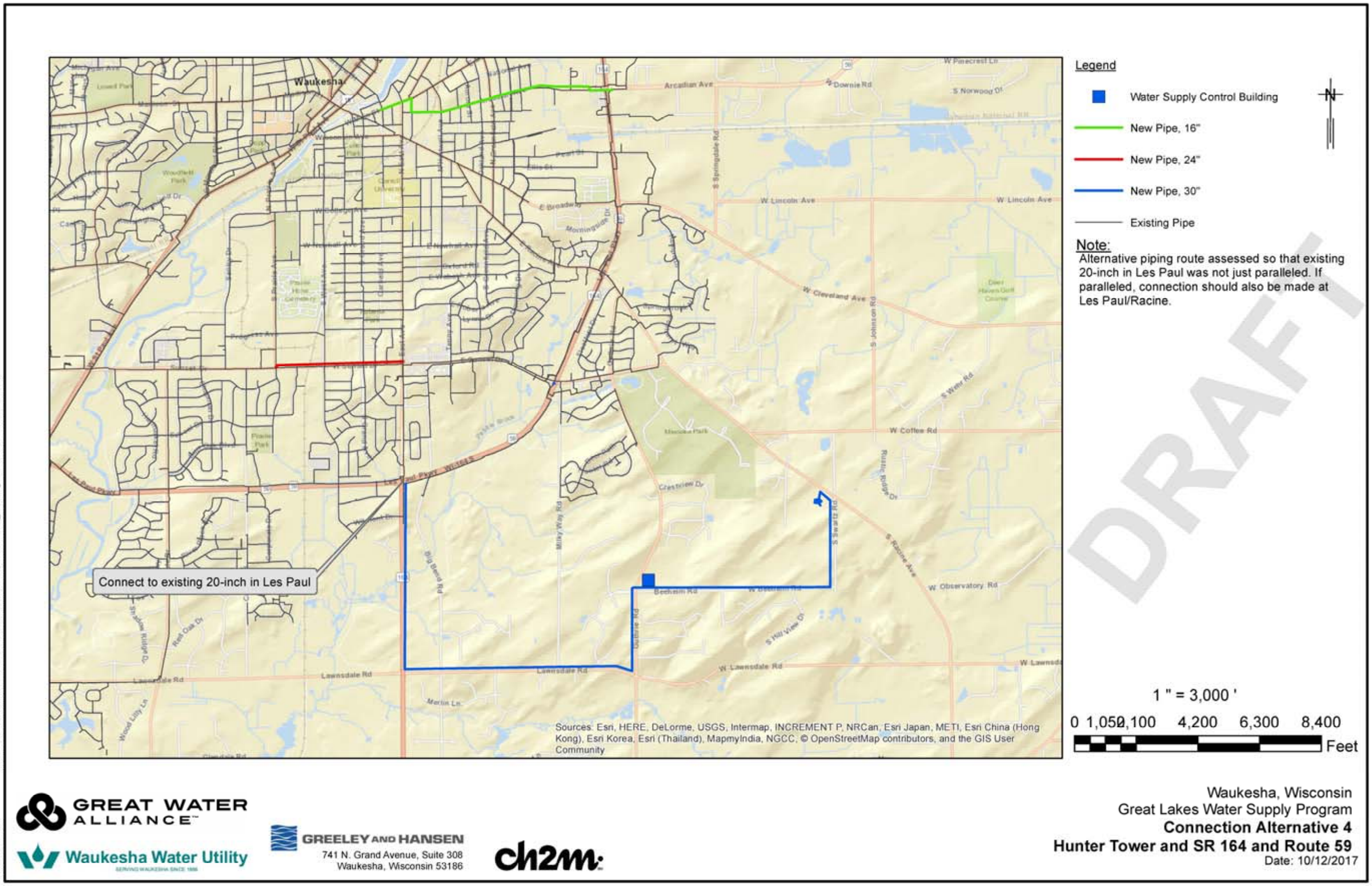
Waukesha, Wisconsin
Great Lakes Water Supply Program
Connection Alternative 2
Hunter Tower, Sunset and Route 59, and Racine and Route 59
Date: 10/12/2017

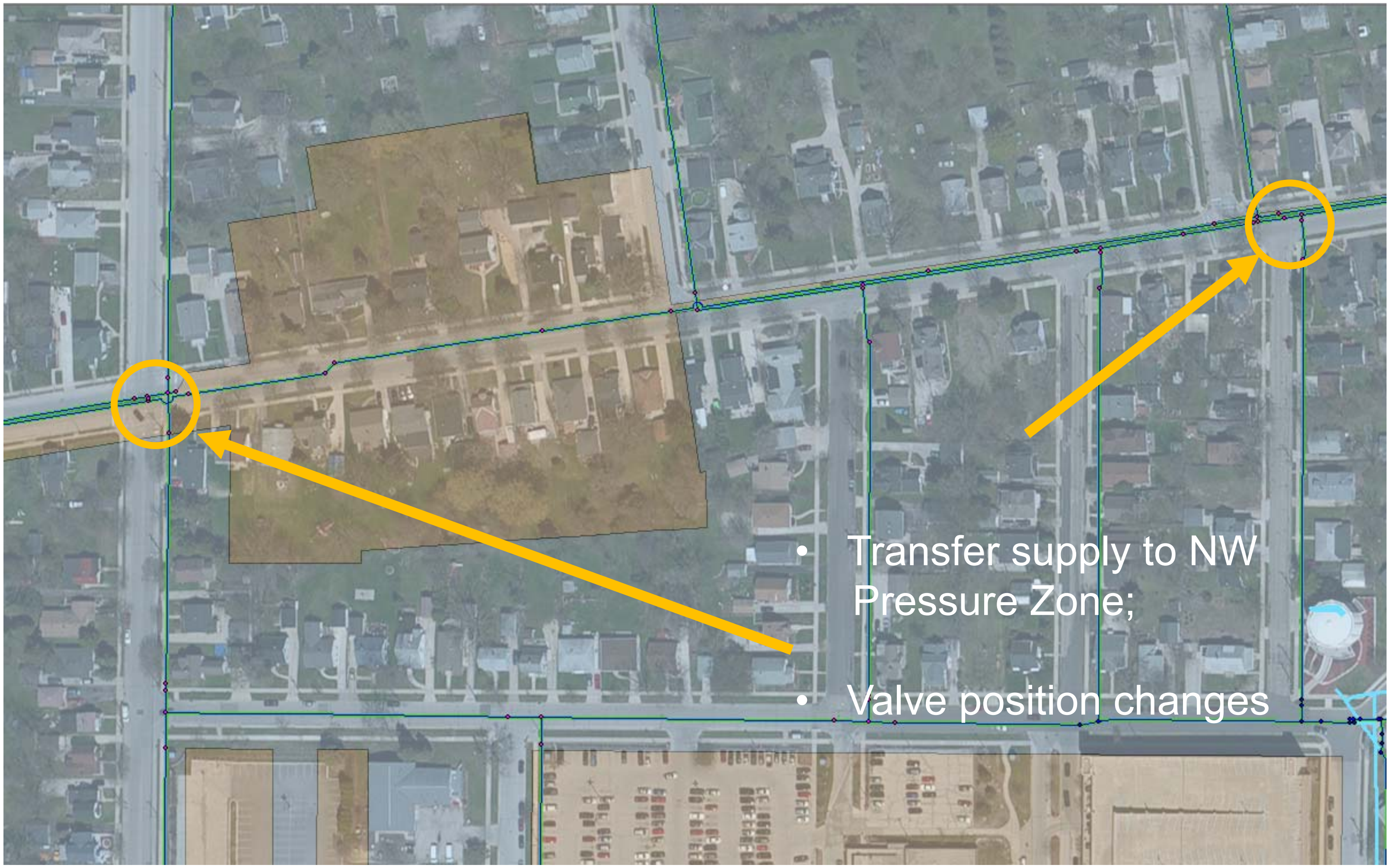
Connection 3: Pipeline Improvements



Connection 4: Pipeline Improvements

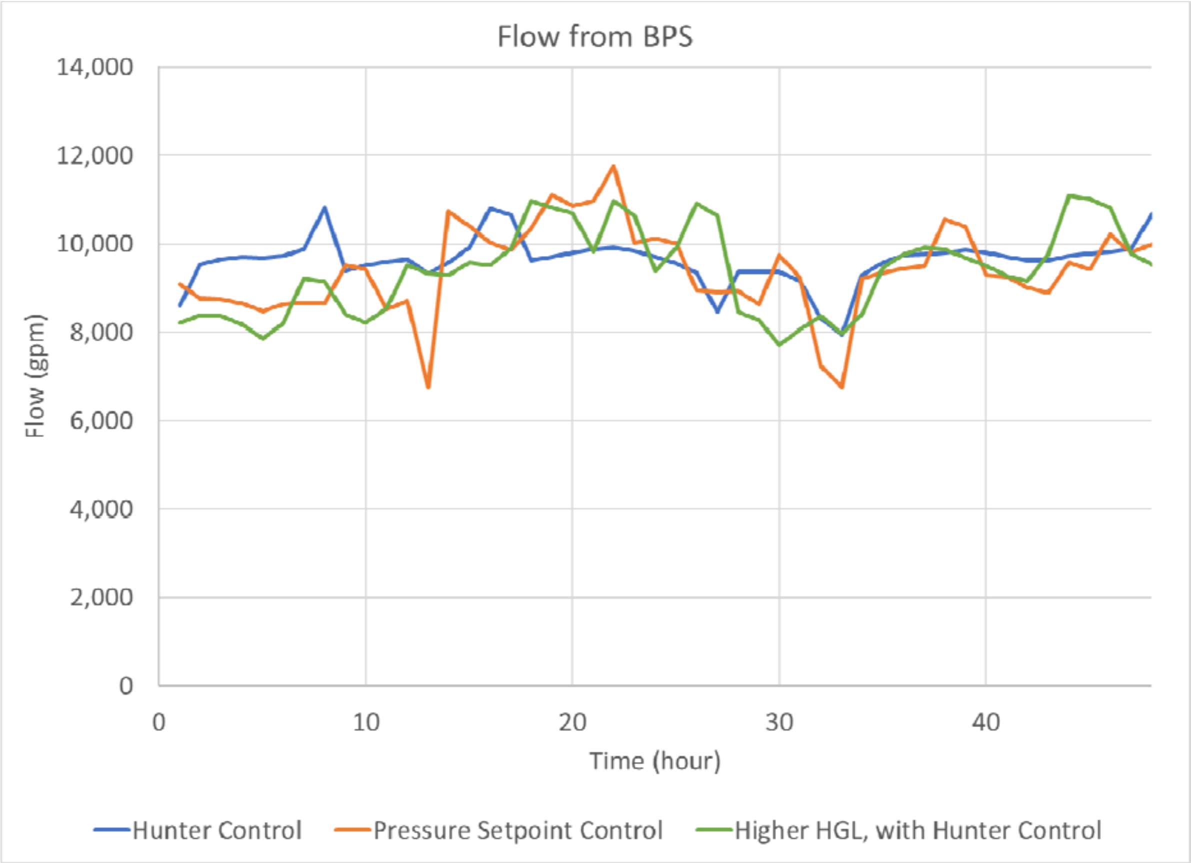


Northwest/Central Zone Realignment



Connection 1: BPS Control

- BPS is anticipated to operate 24:7 to provide supply to system
- Supply to Central is buffered by PRV supply
- Similar flow requirements for either Hunter or pressure setpoint control
- Peaks in flow occur when coincident refilling of tanks in Central and pumping to Northwest occurs



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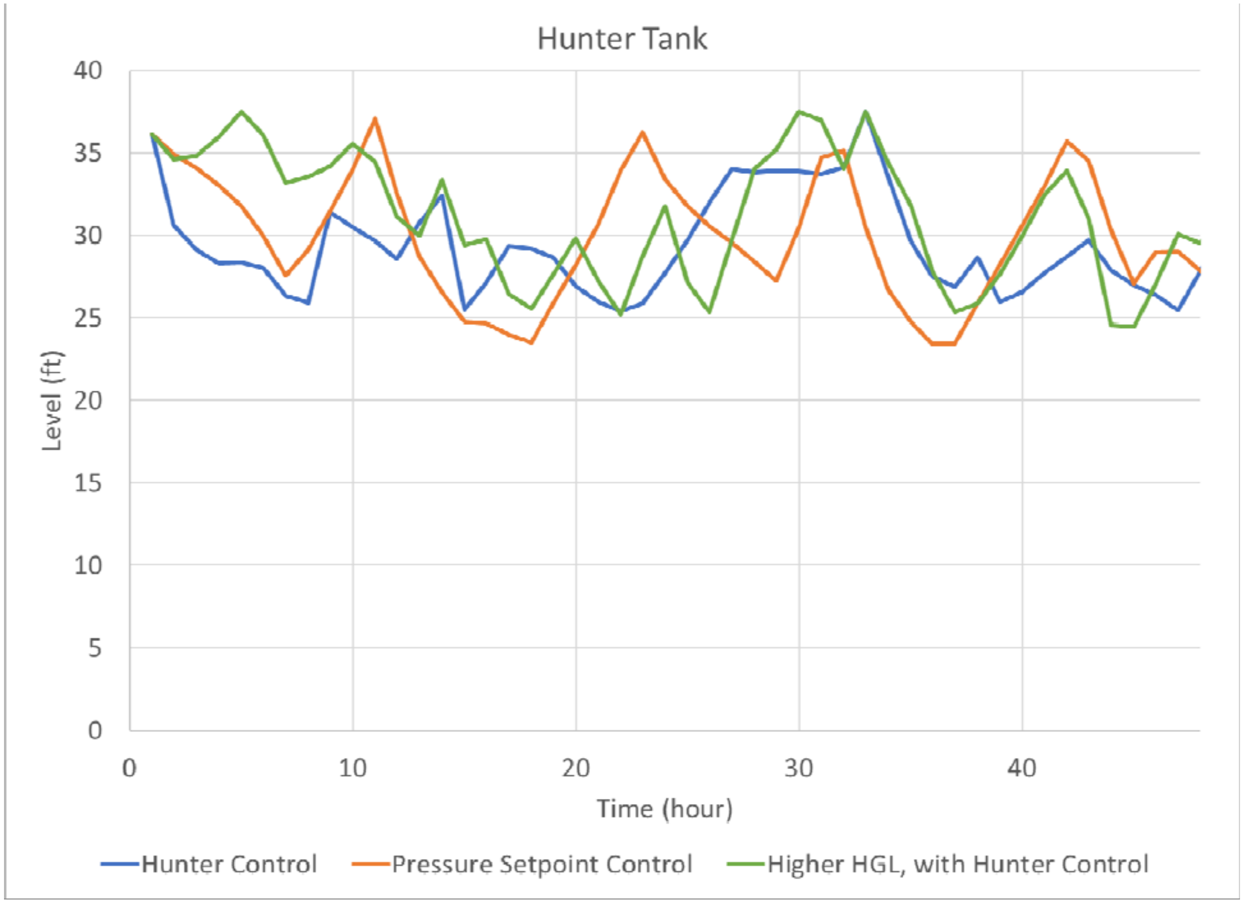
Connection 1: Hunter Operation

- Tank level variation at Hunter is slightly more variable when used as a control point
- Additional steps in pump speed operation can be added/modified to smooth operation



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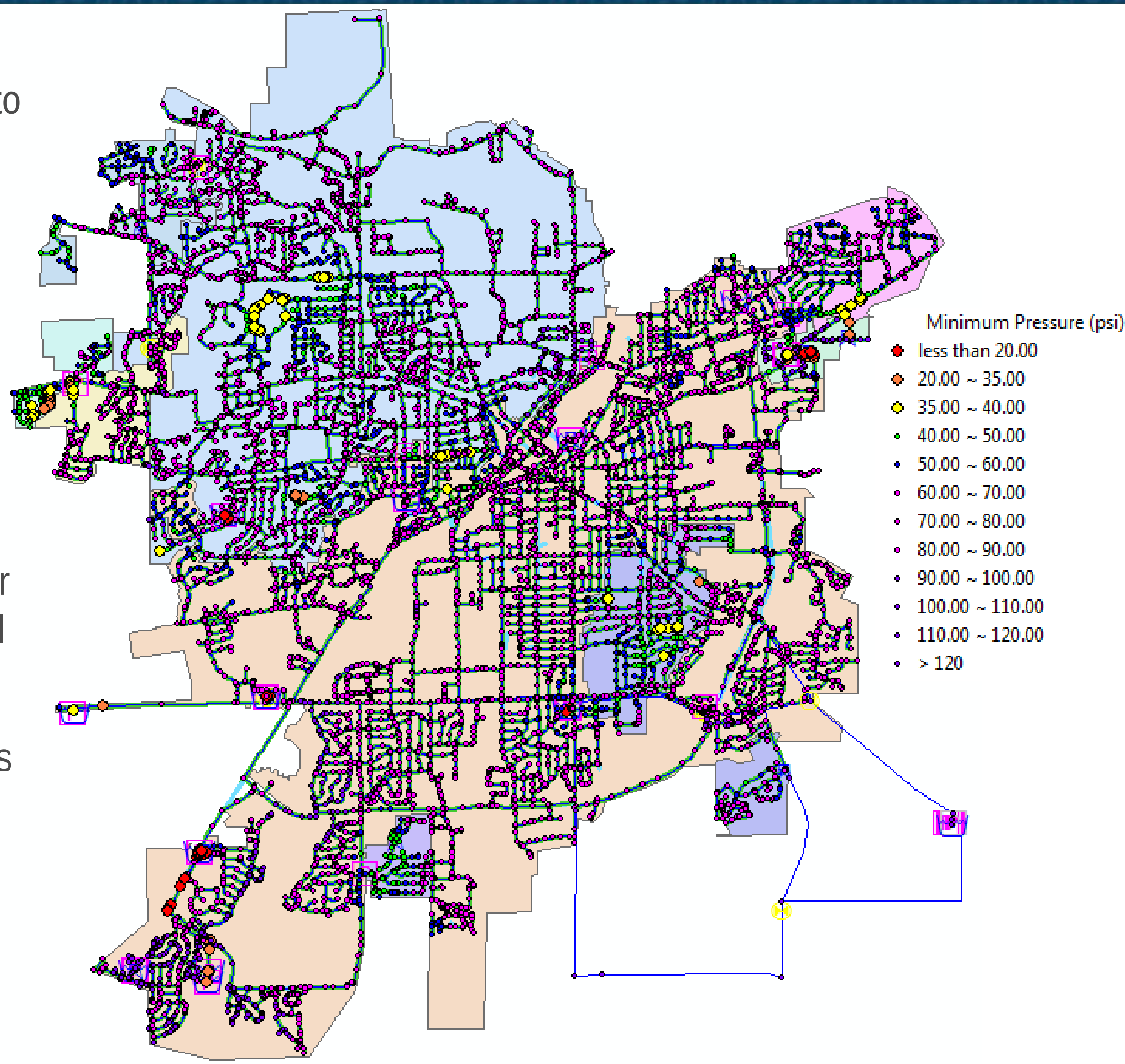
All Connections: HGL Increase at Hillcrest

- Previously not preferred option due to pressure increase
  - Increase of 15 – 20 psi across the system
  - Overflow HGL at Hillcrest increased from 1,000 ft to 1,045 ft
- Revisited to fully assess all options
- No additional piping improvements needed
- Allows for additional volume turnover of Hillcrest, even with smaller (yet all usable) volume at Hillcrest
- Pumping option at Hillcrest to access lower elevation storage would result in increase in HGL in Central Zone, too and would remove floating storage



ADD Operation

- Reduced PRV setpoints to provide for turnover at Hillcrest
- PRV setpoint can be changed throughout the day via telemetry to promote turnover
  - Recommended for ADD or lower demand days

Connection	ADD PRV Setpoint (psi)	MDD PRV Setpoint (psi)
1	64	65.7
2	60/63	61/65
3	61	63
4	76	78

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Compare Scenario Results and Costs

Connection Alternative Cost Comparison

Connection	Connection Specific Piping Cost	System Piping Improvements Cost	Total Cost
1 (Baseline)	$0M	$0M	$0M
2	$3M	$0M	$3M
3	$0M	$0M	$0M
4	$14M	-$5M	$9M

Notes:

1. Differential Connection Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
2. Differential Connection Costs do not include connection Hunter Tower.

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Connection Alternative Operational Comparison

- Variability in Supply Flow → Similar across connection alternatives; Using Hunter requires direct response to level but this is required without direct connection to Hunter as Highline pump turns on
- Energy → Only pumping Southeast High supply “once” with Hunter connection
- Fire Protection at BPS → Hunter can provide some backup for fire protection at BPS in the event of power loss
- Redundancy → Connection 2 with two points of connection provides some redundancy to system
- Impact on SE Customers → Maintain Highline PS for second supply; Tank operation could be more variable as Control point

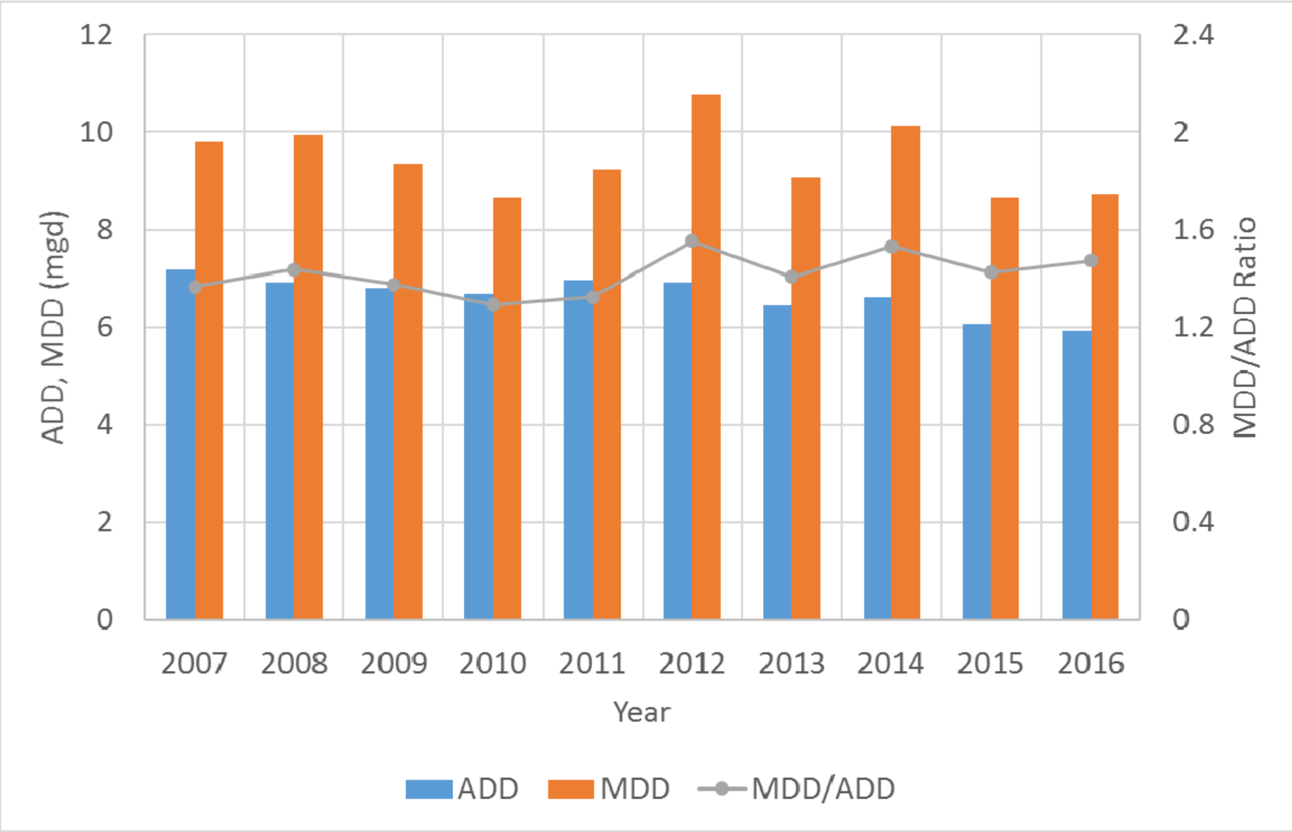
Discuss Recommended Connection Point and Improvement Phasing

Recommended Connection Point

- Connection Point 1 and 3 are similar in cost and are the lowest cost option as compared to other options
- Connection Point 1 can use the existing Highline Booster Pump Station site for the Water Supply Control Building

Improvement Phasing

- Pipeline improvements are needed/triggered when MDD increases above 12 mgd
- *Instantaneous* flows higher than 12 mgd can be delivered



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Next Steps

Next Steps

- Update alternative features from today's discussion
- Incorporate recommended connection point into the Preliminary Design Report
- Finalize documentation for calibration and connection alternative evaluation
- Support IDSE evaluation and water quality evaluation

Summary and Wrap-up

Summary Wrap-Up

- Model Scenario evaluation showed similar performance and improvement requirements across connections due to availability of piping along Les Paul
- Connection 1 is the least cost alternative that makes use of existing property for new facilities (Water Supply Control Building)

THANK YOU

Waukesha Water Utility GREELEY AND HANSEN

SUMMARY

The Great Lakes Water Supply Program Water Supply Facilities Site Selection Meeting was held in the WWU Large Conference Room at 1:30 PM on May 23, 2017 to agree on the recommendations for site locations of the Water Supply Pump Station and Booster Pump Station.

The attendees are listed on the attached sign-in sheet. The agenda, presentation, meeting summary, and handouts are attached. The actions items are summarized in the table below.

	Action Item	Action By	Due Date
1.	Provide the PM with the effective storage in WWU's distribution system, if known, and the Hillcrest Reservoir.	K. Zylstra	**5/26/2017**
2.	Provide the PM with WWU emergency storage requirements.	K. Zylstra	**5/26/2017**
3.	Prepare further refined site layouts for reservoir(s) and BPS at site B-10.1 and B-11.	L. Melcher	**6/2/2017**
4.	Evaluate parallel pipe line from BPS to Waukesha.	L. Melcher	**6/2/2017**

Welcome

a) Workshop attendees introduced themselves and their role in the Program.
b) The objectives of the meeting and the work plan moving forward were discussed.

1) Site Screening Overview:

a) The work performed to date for the site screening process was discussed.
b) A schematic of proposed and future pumping station configurations with pump capacities was discussed.
    i) WWU commented on the number and size of the pumps at the BPS. WWU asked if another small pump should be included verses a larger pump to provide flexibility in meeting diurnal flows. The team will continue to evaluate the size and number of pumps to meet the demand curves and distribution system requirements with consideration for smaller sized pumps.
c) The overall map with areas considered for the WSPS, BPS, and potential FBPS was presented.
d) WWU stated that the reservoir at Minooka Park should be sized to accommodate a 24-hour pumping schedule from the water supplier.
    a. WWU will provide information on the emergency storage required for the existing distribution system.
    b. WWU will provide the effective storage at in the distribution system, if known, and at the Hillcrest Reservoir.

2) Desktop Analysis:

a) The WSPS site locations in Area A (Oak Creek and Franklin) were discussed.
    i) It was noted that Oak Creek is planning to expand their existing pumping station at 22nd and Ryan Rd. for the WSPS.

ii) Site A-7 was determined to be a feasible alternate site in Oak Creek if additional space is needed in conjunction with Oak Creek's existing pumping station.
iii) It was decided that no further investigation of the WSPS site will be conducted at this time.
iv) The Franklin Nature Center along Puetz Road was considered as a potential site but was eliminated from consideration due to the amount of tree coverage, wetlands, floodplain, and potential protected environmental corridors throughout the site.

b) The BPS site locations in Area B, Area C, Area D, and Area F were discussed:
   i) WWU requested that the team will continue to evaluate Site B-10.1 in Minooka Park for a BPS along Routes 2 and 3 due to the opportunities with the Park District. The team will prepare site exhibits that can be used in communication with the Park District.
   ii) Site B-11 was selected as the alternate for a BPS along Routes 2 and 3. Exhibits will also be prepared for this site.
   iii) The City of New Berlin Park along Calhoun Street was considered as a potential site but eliminated from consideration due to the ball fields covering the developable portion of the site, slope and tree coverage on the remainder of the site along with floodplain and wetlands extending through the site.
   iv) Site C-14 was selected as the preferred site for a BPS along Route 4 and Site F-9 was selected as an alternate site.
   v) The team discussed sites for a FBPS, and decided that no further investigation of FBPS sites will be conducted at this time. Opportunities for FBPS will be included in the Route Study Report.

3) **Hydraulic Analysis:**
   a) It was noted that the HGL of 1050 ft at the point of connection to WWU's distribution system is an assumed elevation to be able to convey flow from the connection point to an elevation of 1000 ft at Hillcrest Reservoir.
   b) WWU requested an evaluation of a redundant discharge line (from the BPS to WWU) with a separate point of connection to the WWU distribution system.

4) **Recommendations:**
   a) The team reached consensus on site recommendations.
      i) The WSPS will be located at Oak Creek's pumping station. Site A-7 provides an alternate site to the existing pumping station.
      ii) The preferred BPS site for Routes 2 and 3 is Site B-10.1, with the alternative site as Site B-11.
      iii) The preferred BPS site for Route 4 is Site C-14, with the alternative site as Site F-9.

5) **Summary Wrap-Up and Action Items:**
   a) The team will evaluate BPS Sites B-10.1 and B-11 further while refining the pumping station layouts and design.
   b) The team will continue to evaluate pump sizing at the BPS in conjunction with demand evaluation and distribution system modeling

The action items are summarized in the table on page 1 of this summary.

This meeting summary reflects the discussions and decisions reached at the meeting/workshop. If no objections are put forth within 5 business days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting/workshop.

GREAT WATER
ALLIANCE

WATER SUPPLY FACILITIES SITE SELECTION MEETING
SIGN-IN SHEET

May 23, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesah Water Utility	[redacted]
2	Kelly Zylstra	Waukesah Water Utility	
3	Nicole Spieles	Greeley and Hansen	
4	Katie Richardson	Greeley and Hansen	
5	Lee Melcher	Greeley and Hansen	
6	Brooke Henry	Greeley and Hansen	
7	Kevin Richardson	Kevin Richardson Consulting	
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GREAT WATER ALLIANCE

Date/Time: May 23, 2017, 1:30 p.m. –2:30 p.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Brooke Henry, GH
Lee Melcher, GH
Katie Richardson, GH
Nicole Spieles, GH
Kevin Richardson

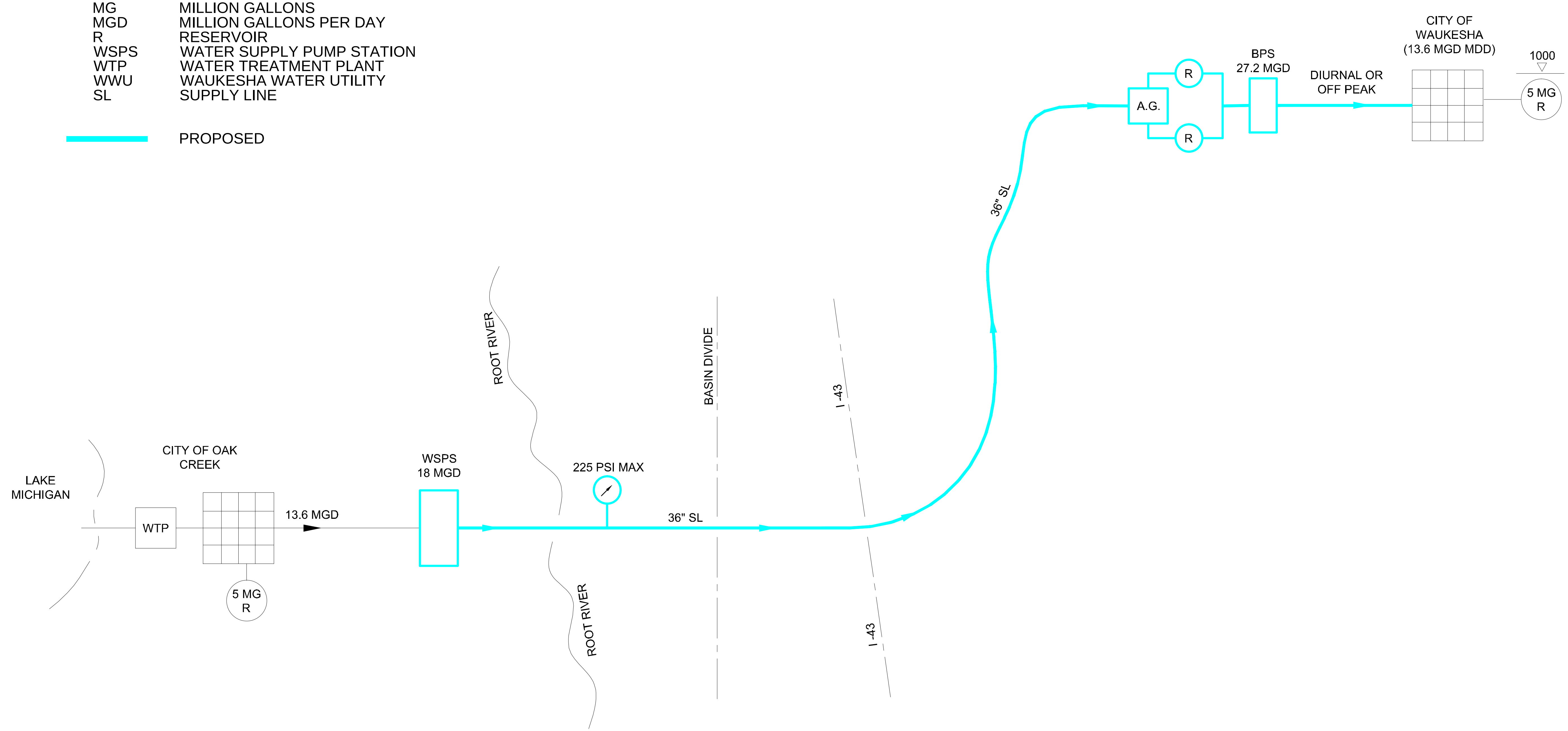
Time	Topic	Presenter(s)
1:30 p.m.	Welcome Goals and Objectives	Nicole Spieles
1:35 p.m.	Site Screening Overview	Brooke Henry
1:40 p.m.	Desktop Analysis	Brooke Henry
2:00 p.m.	Hydraulic Analysis	Lee Melcher
2:20 p.m.	Recommendations	Lee Melcher
2:25 p.m.	Summary Wrap-Up and Action Items	Lee Melcher
2:30 p.m.	Adjourn	

HANDOUT NO. 1

LEGEND

AG	AIR GAP
BPS	BOOSTER PUMP STATION
FBPS	FUTURE BOOSTER PUMP STATION
MG	MILLION GALLONS
MGD	MILLION GALLONS PER DAY
R	RESERVOIR
WSPS	WATER SUPPLY PUMP STATION
WTP	WATER TREATMENT PLANT
WWU	WAUKESHA WATER UTILITY
SL	SUPPLY LINE

PROPOSED



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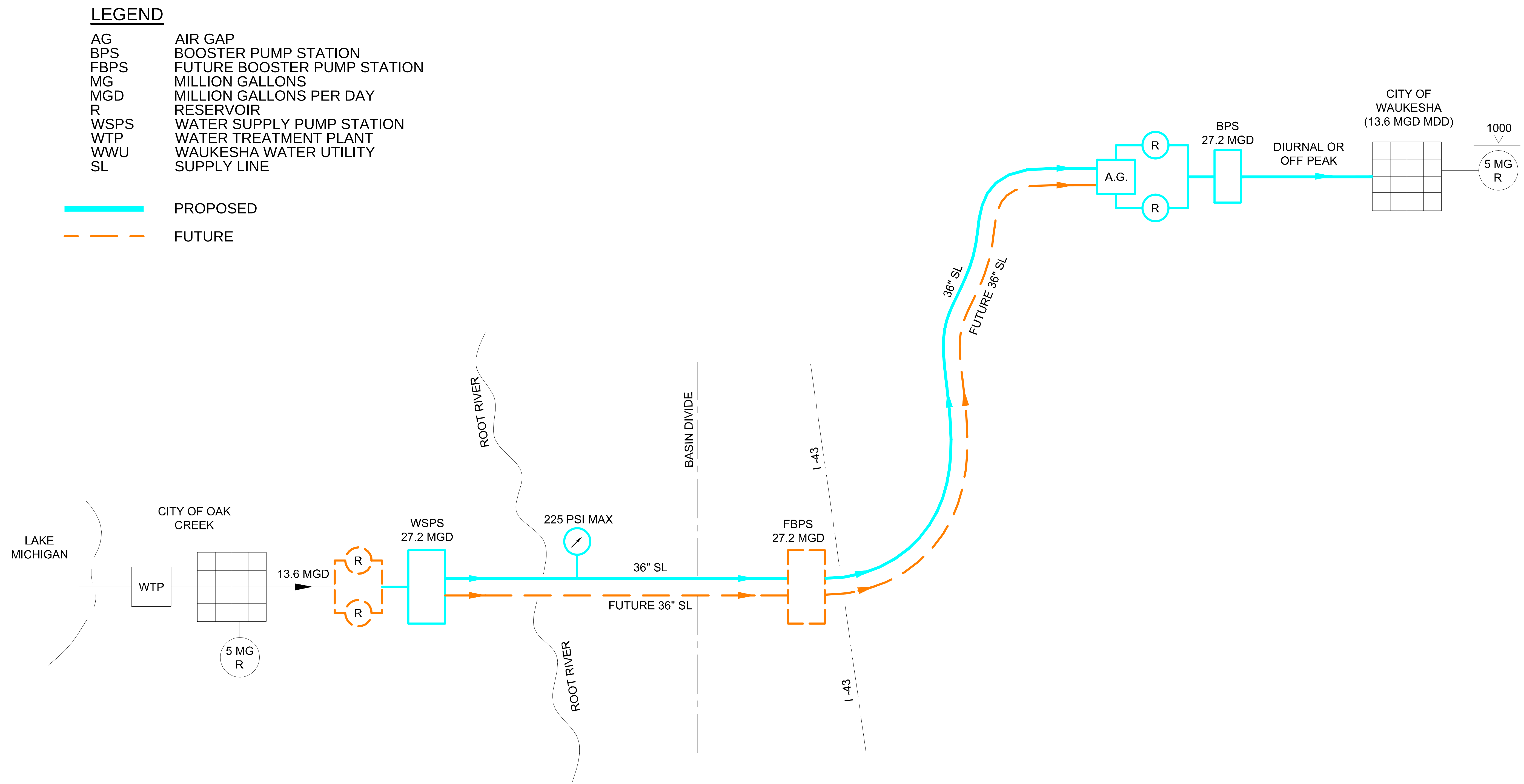
WAUKESHA, WISCONSIN
GREAT LAKES WATER SUPPLY PROGRAM
WATER SUPPLY FACILITIES SITE SELECTION
HANDOUT 1
5/23/2017

HANDOUT NO. 2



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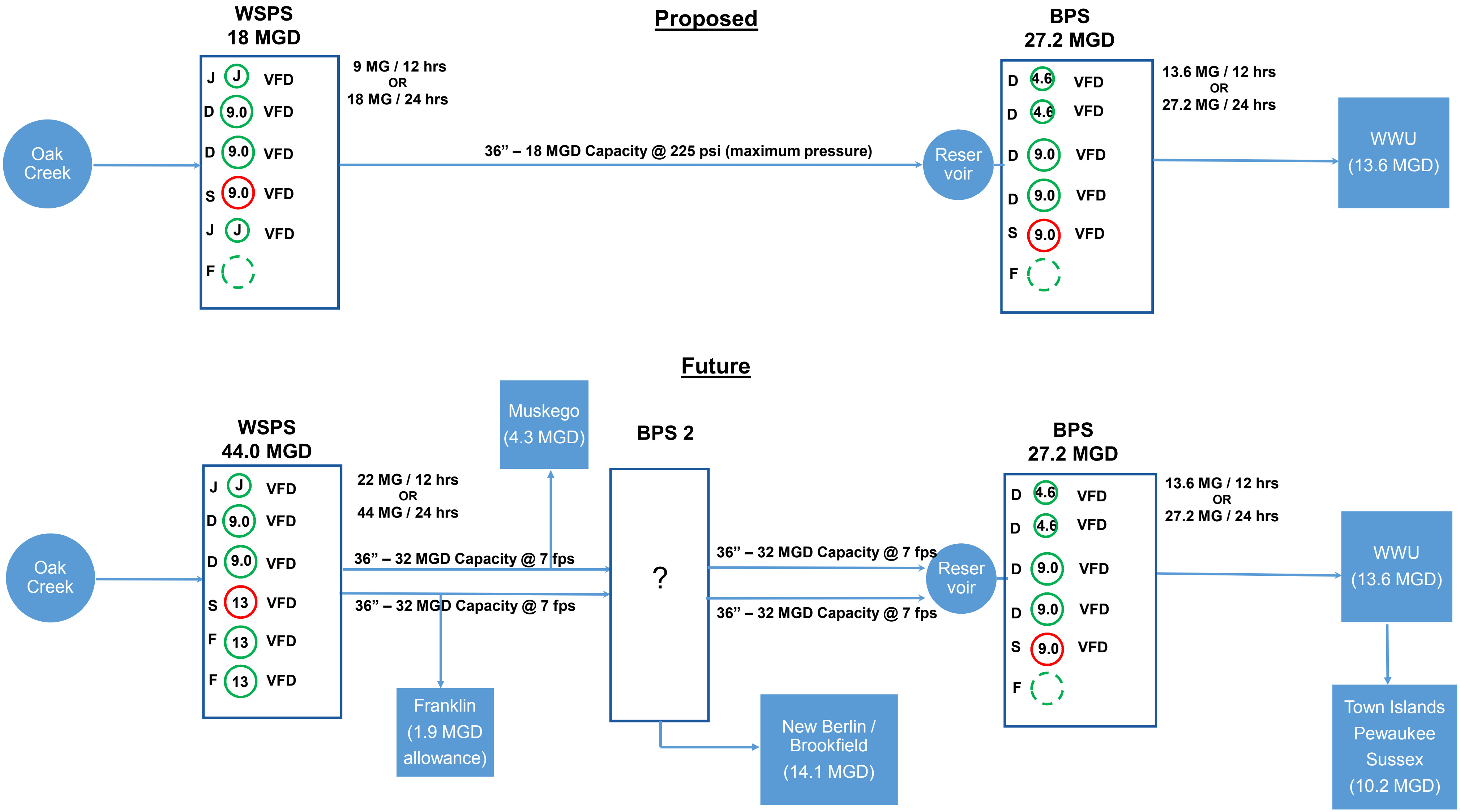
WAUKESHA, WISCONSIN
GREAT LAKES WATER SUPPLY PROGRAM
WATER SUPPLY FACILITIES SITE SELECTION
HANDOUT 2
5/23/2017

Great Lakes Water Supply Program (Draft)

Draft 05/16/2017

Pump Selection (Draft)



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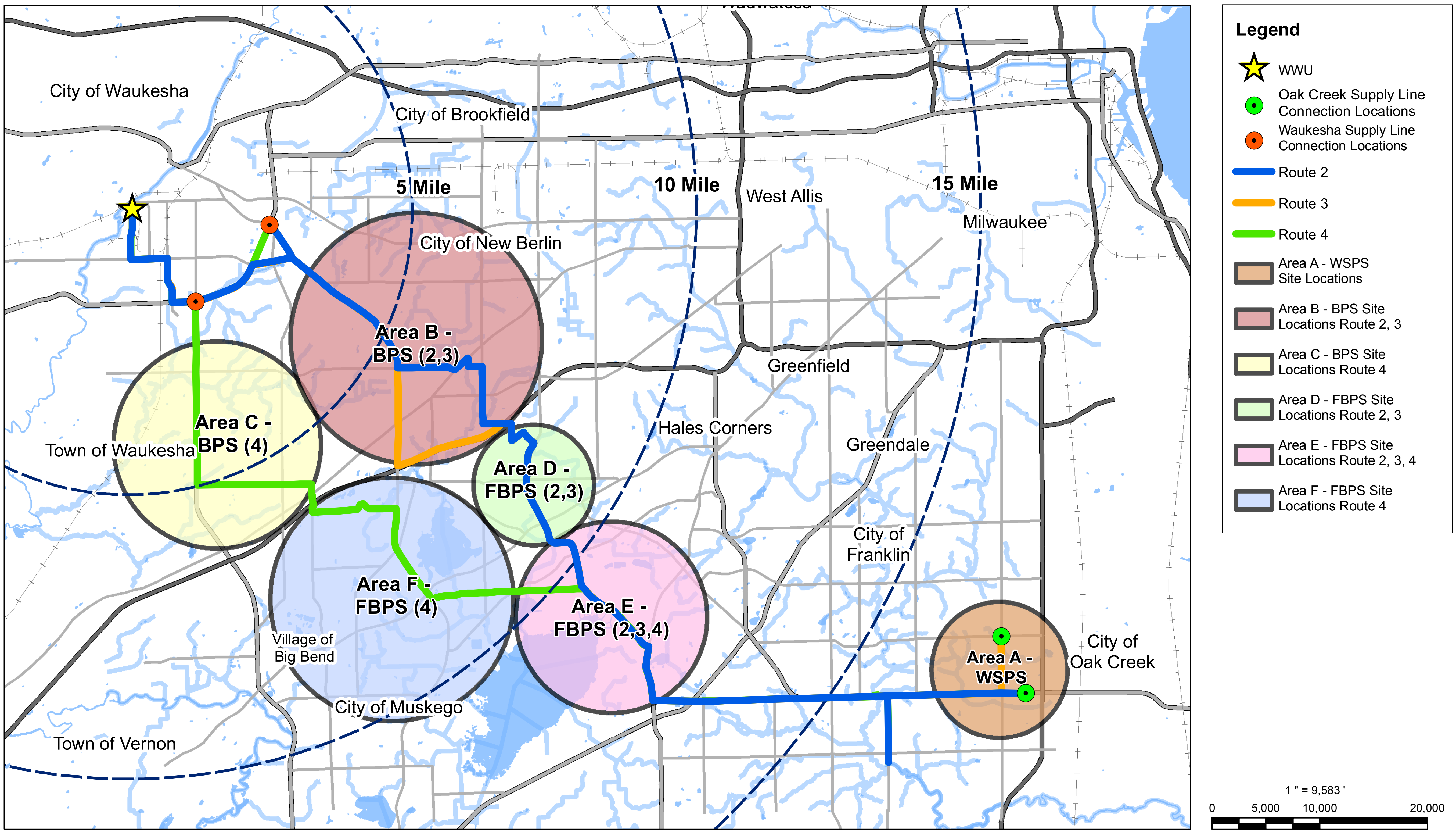

GREAT WATER ALLIANCE™

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

GREELEY AND HANSEN
741 N. Grand Avenue, Suite 308
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Water Supply Facilities Alternative Evaluation
Potential Facility Site Locations
Date: 5/23/2017

Plotted: 5/23/2017
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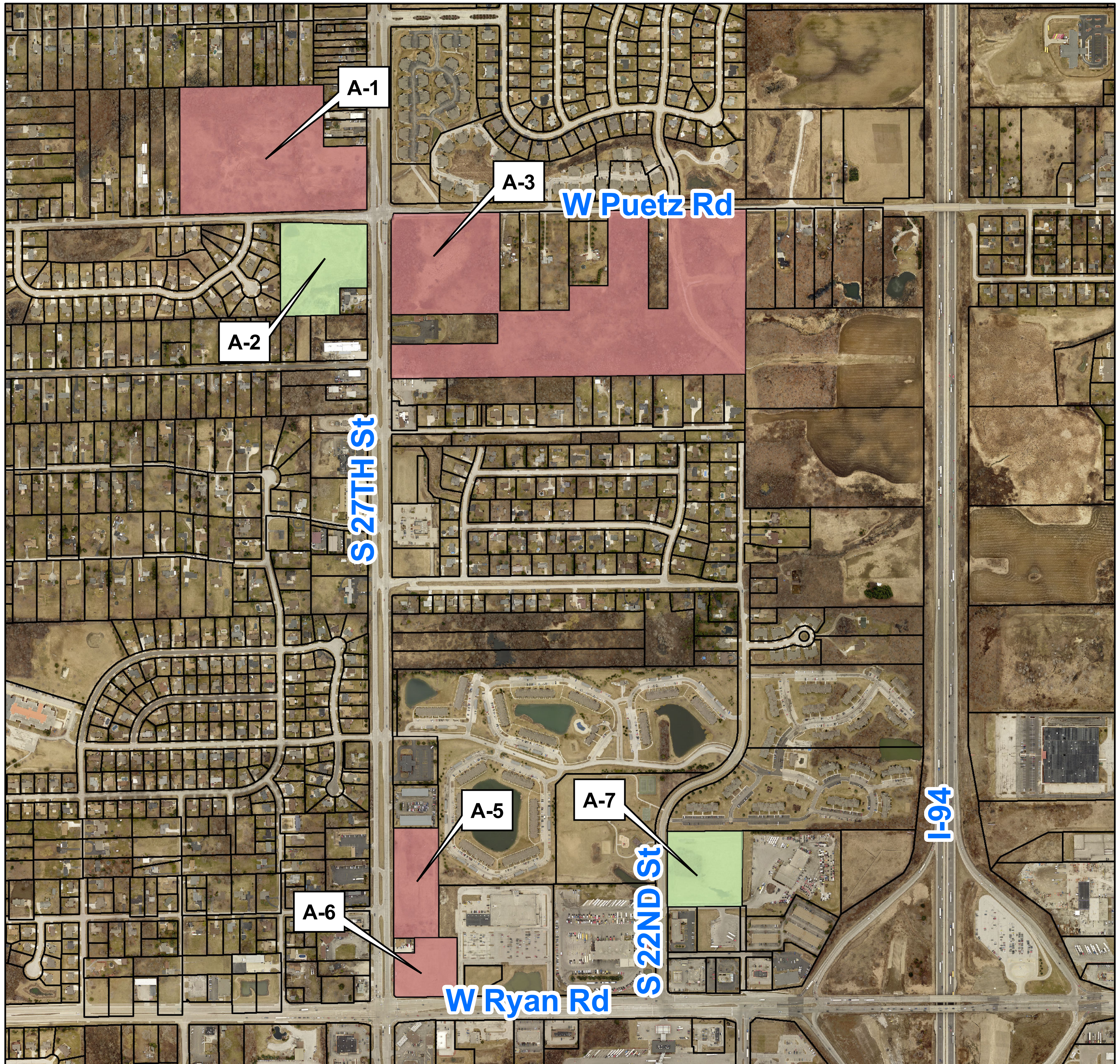

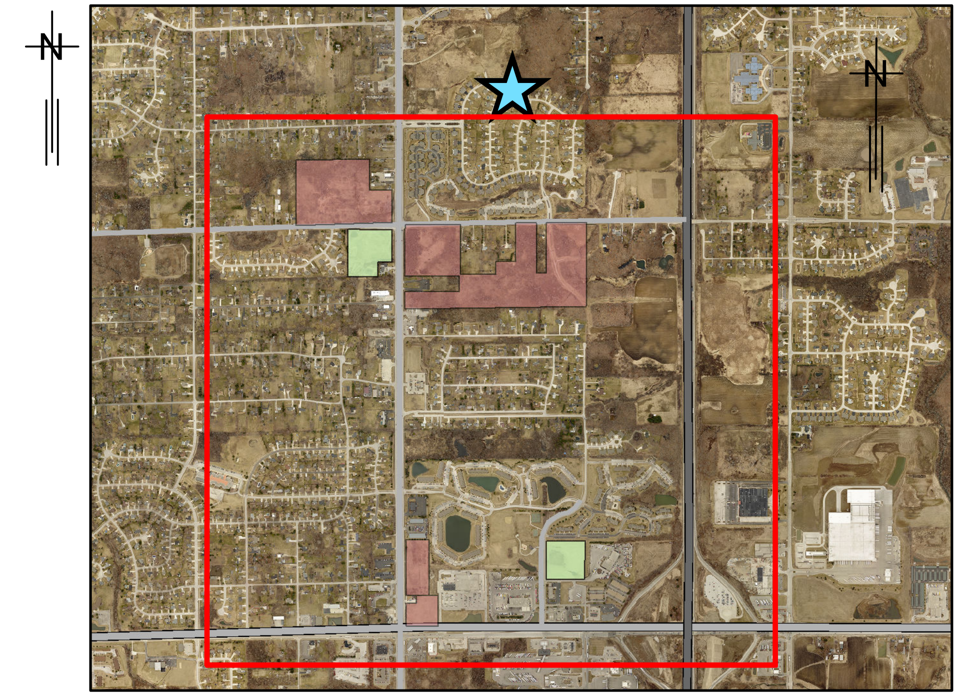

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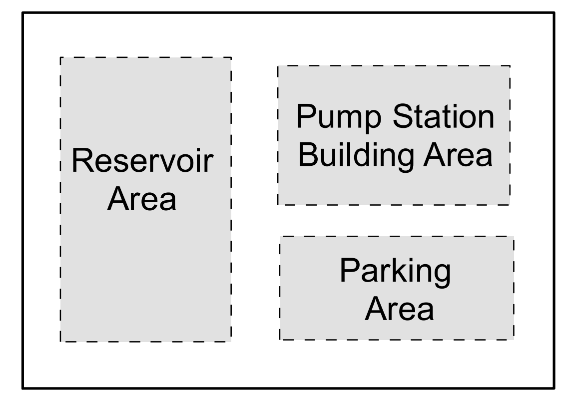

Conceptual Site Layout
Estimated Acreage 5.0 Acres

Site Number	Acreage
A-1	21.5
A-2	7.4
A-3	53.5
A-5	5.0
A-6	3.7
A-7	5.7

Legend

- Oak Creek Reservoir
- Recommended Site
- Evaluated Site

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Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

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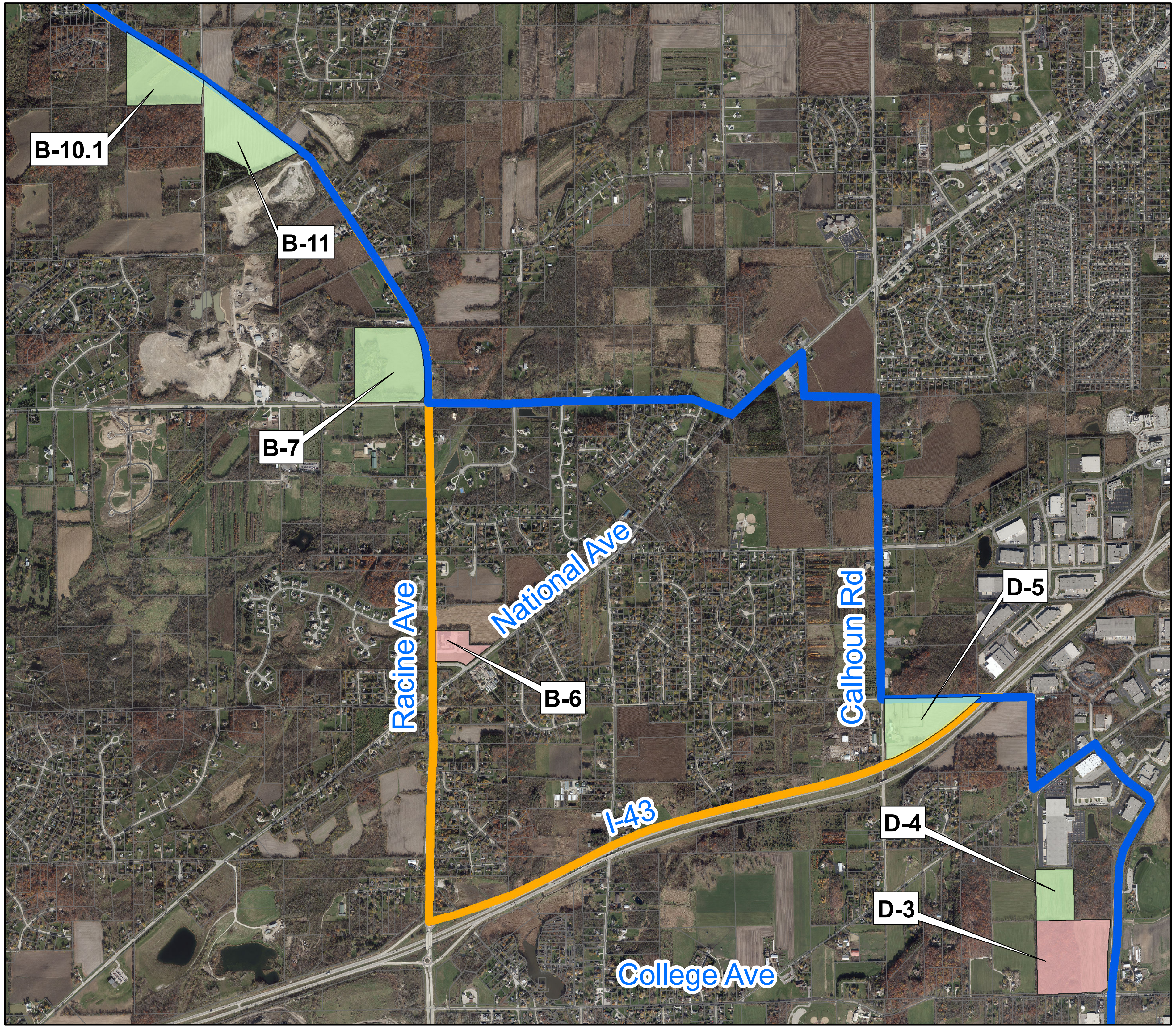
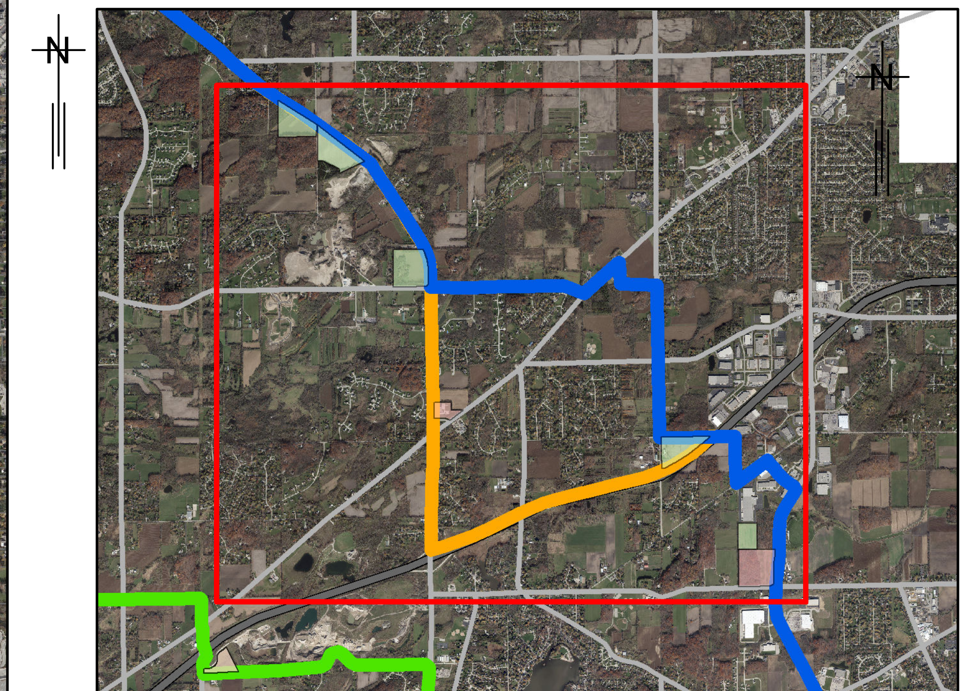
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Water Supply Facilities Alternative Evaluation
Potential Facility Site Locations - Area A
Date: 5/23/2017

Plotted: 5/23/2017
Document Path: \\GH-DATA01\client02\15310-Waukesha Great Lakes Water Supply PM-CM24 GIS\24.05_Working_MXDs\Working_Facility_Sites_Analysis\Site Selection\Site_Selection_WSPS.mxd





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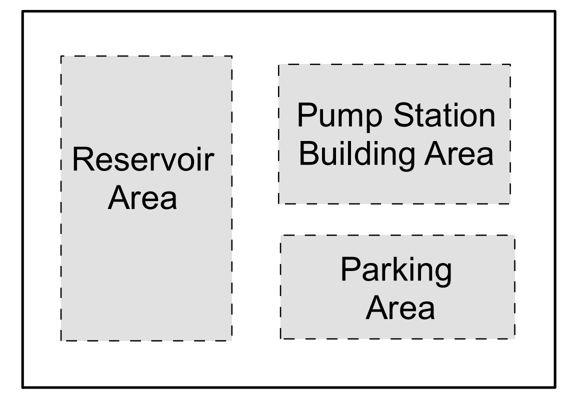

Conceptual Site Layout
Estimated Acreage 8.0 Acres

Site Number	Acreage
B-10.1	27
B-11	29
B-7	57
B-6	9
D-5	25
D-4	13
D-3	36

Legend

- Recommended Site
- Evaluated Site

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Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

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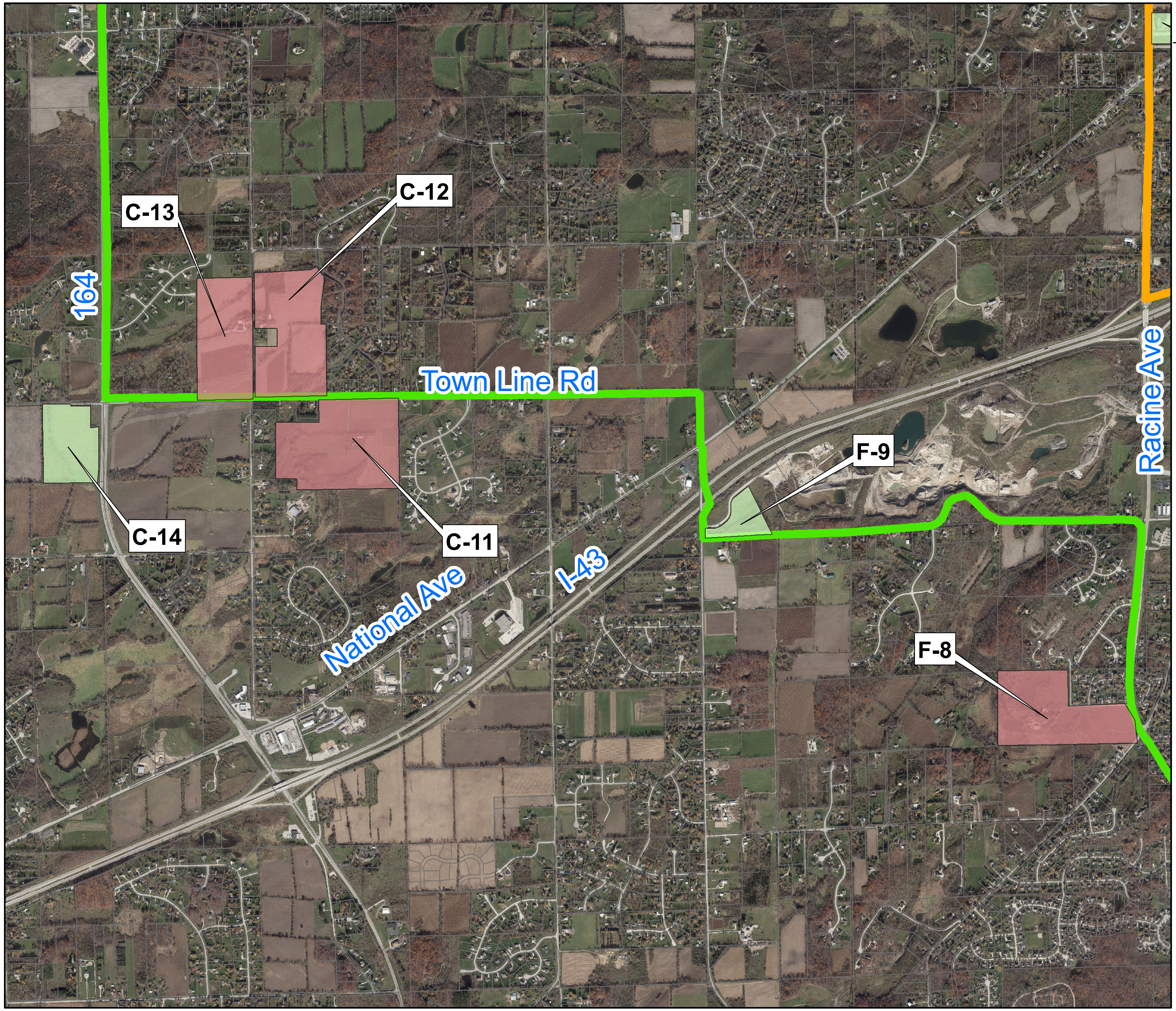
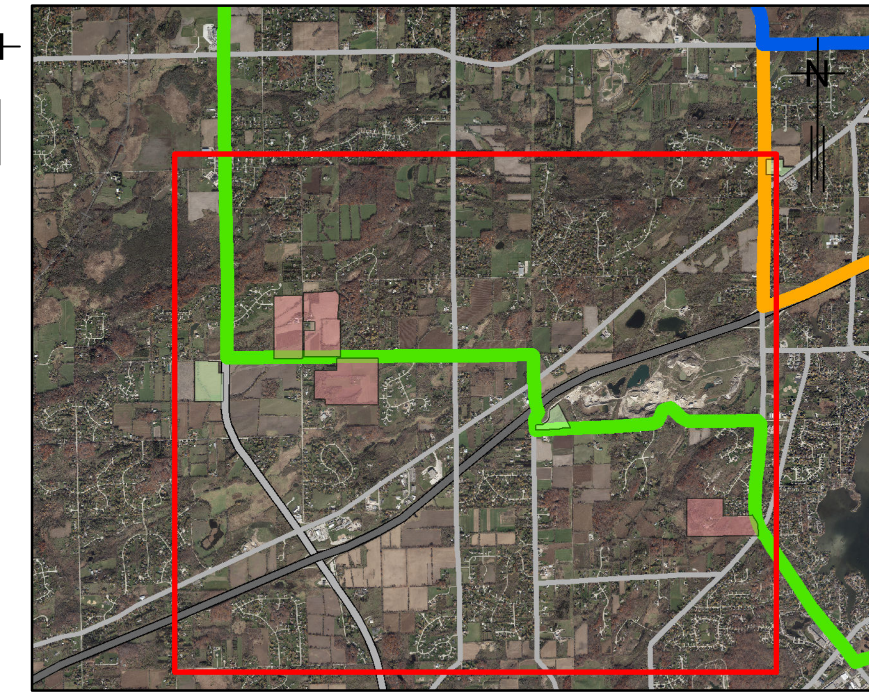
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Water Supply Facilities Alternative Evaluation
Potential Facility Site Locations - Area B / D
Date: 5/23/2017

HANDOUT NO. 6





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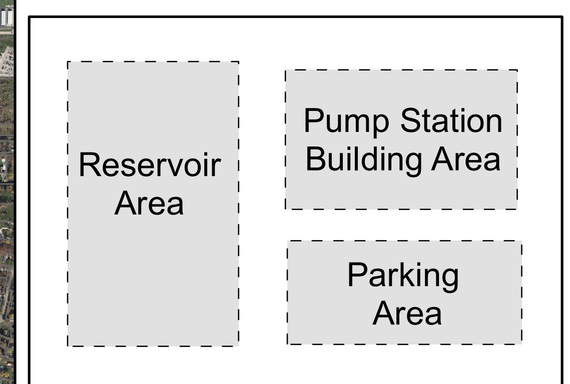

Conceptual Site Layout
Estimated Acreage 8.0 Acres

Site Number	Acreage
F-8	58
F-9	12
C-11	75
C-12	60
C-13	50
C-14	30

Legend

- Recommended Site
- Evaluated Site

GREAT WATER ALLIANCE™

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

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741 N. Grand Avenue, Suite 308
Waukesha, Wisconsin 53186

Waukesha, Wisconsin
Great Lakes Water Supply Program
Water Supply Facilities Alternative Evaluation
Potential Facility Site Locations - Area C / F
Date: 5/23/2017

Plotted: 5/23/2017
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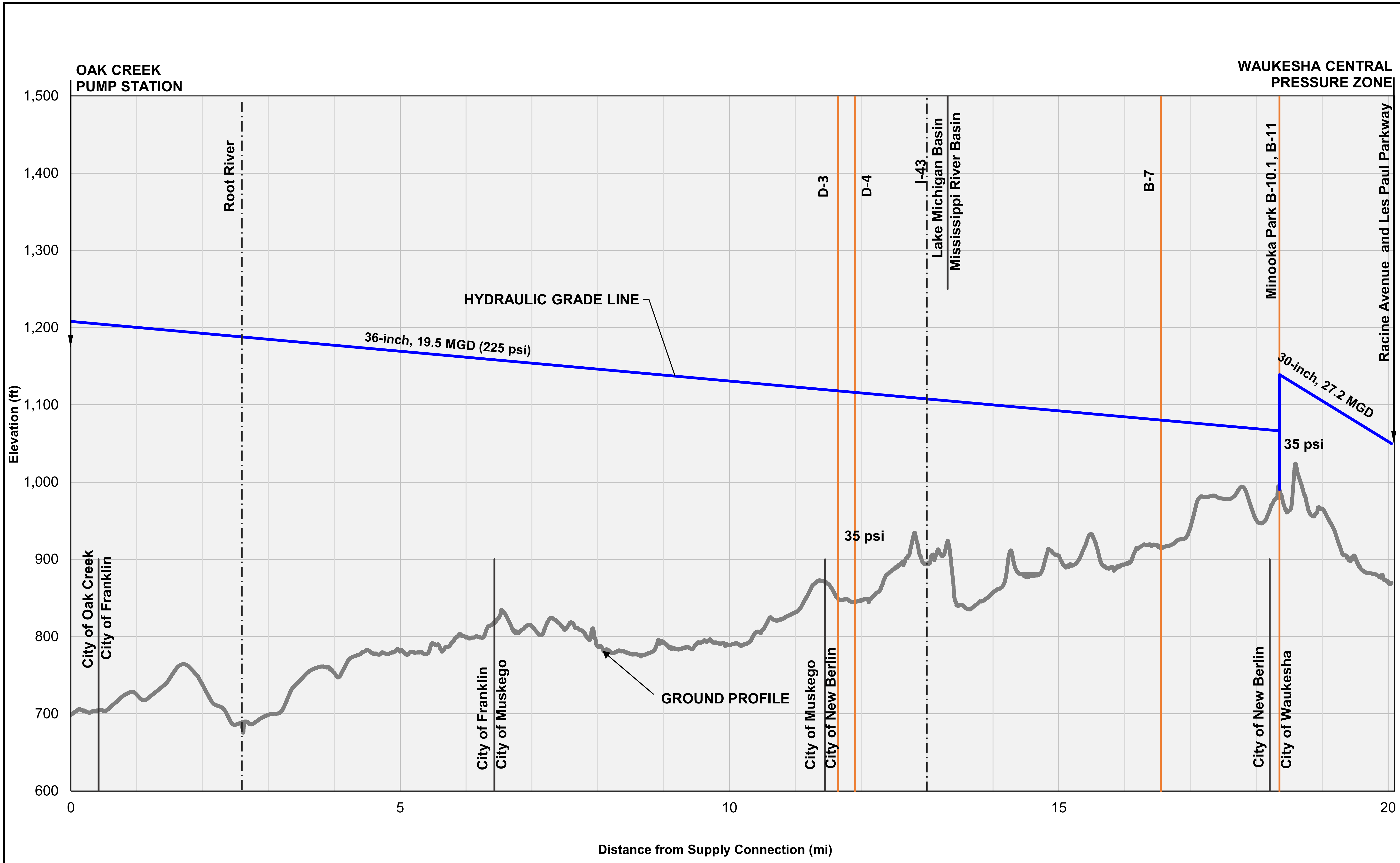
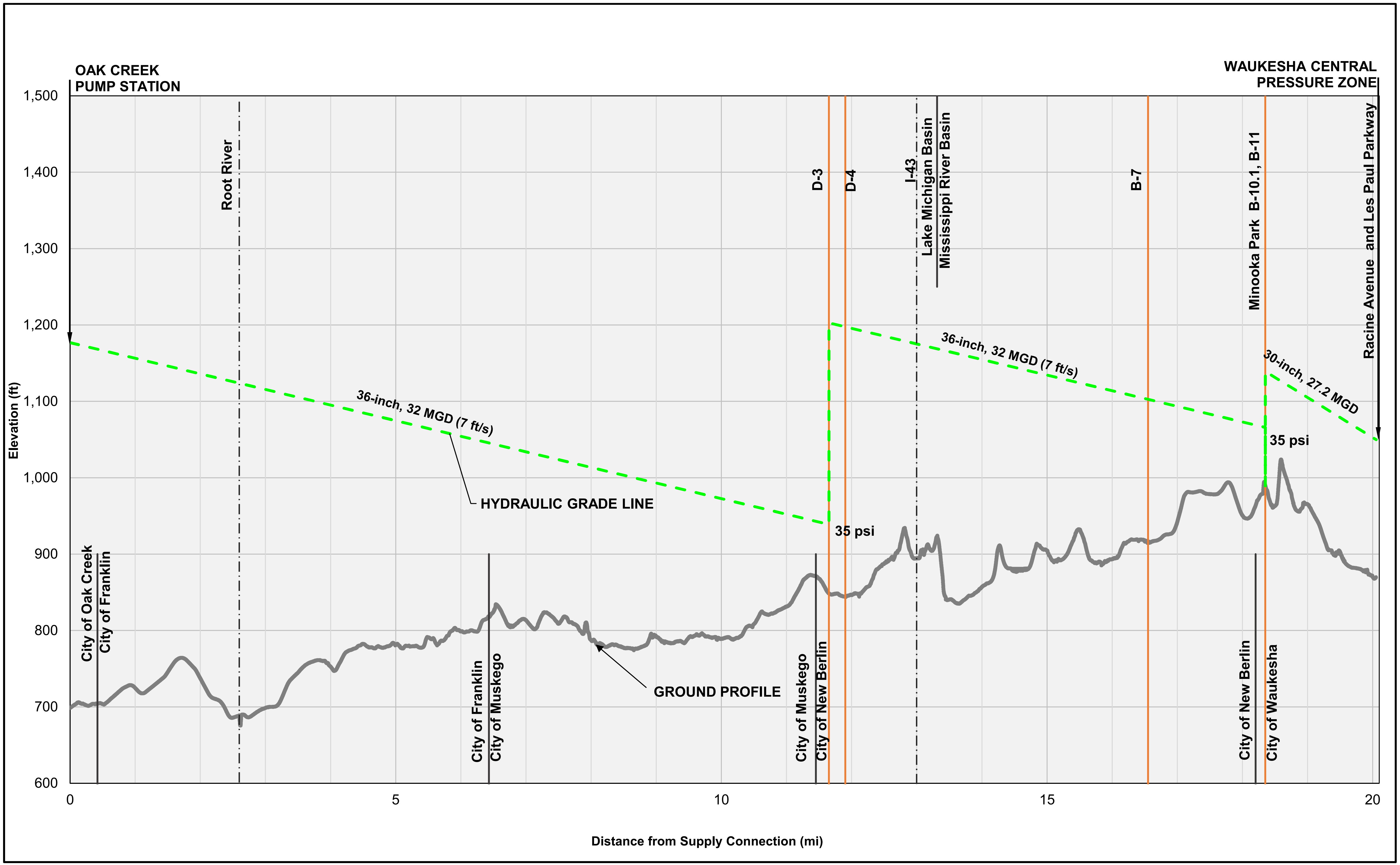
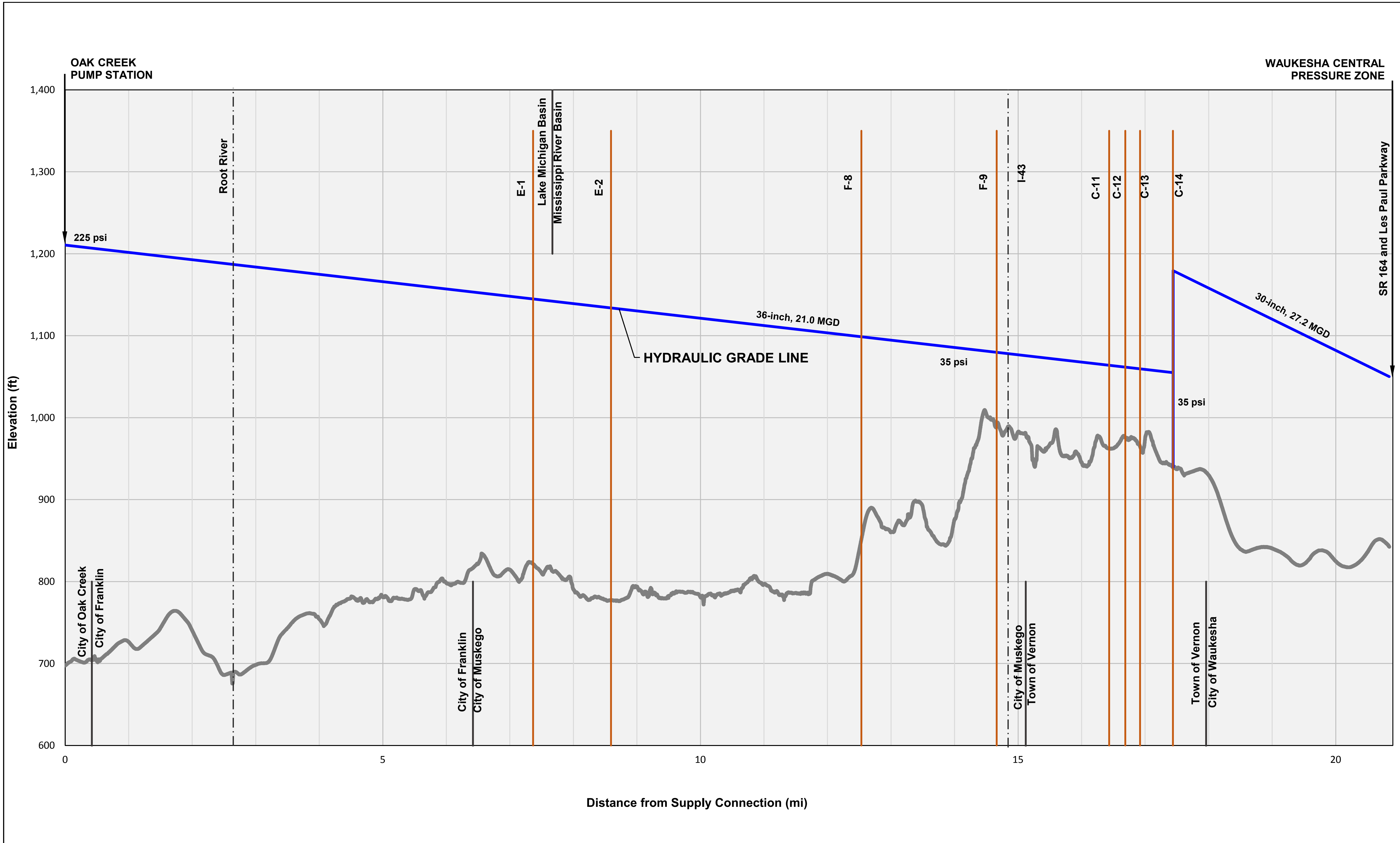


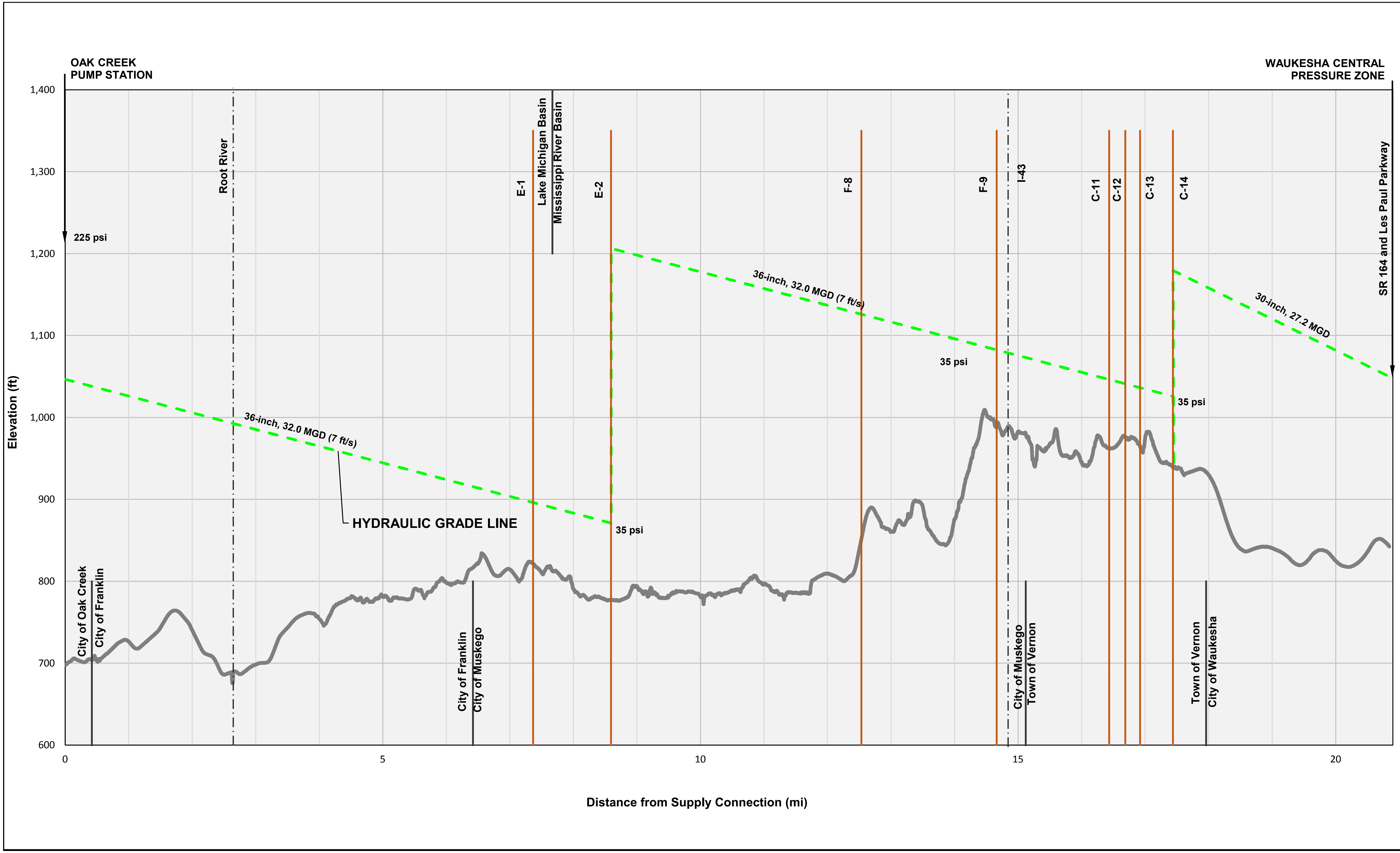
OAK CREEK PUMP STATION
WAUKESHA CENTRAL PRESSURE ZONE
HYDRAULIC GRADE LINE
36-inch, 19.5 MGD (225 psi)
30-inch, 27.2 MGD
35 psi
35 psi
GROUND PROFILE
Root River
D-3
D-4
I-43
Lake Michigan Basin
Mississippi River Basin
B-7
Minooka Park B-10.1, B-11
Racine Avenue and Les Paul Parkway
City of Oak Creek
City of Franklin
City of Franklin
City of Muskego
City of Muskego
City of New Berlin
City of New Berlin
City of Waukesha
Elevation (ft)
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
0
5
10
15
20
Distance from Supply Connection (mi)



OAK CREEK PUMP STATION
WAUKESHA CENTRAL PRESSURE ZONE
Elevation (ft)
Distance from Supply Connection (mi)
Root River
D-3
D-4
I-43
Lake Michigan Basin
Mississippi River Basin
B-7
Minooka Park B-10.1, B-11
Racine Avenue and Les Paul Parkway
36-inch, 32 MGD (7 ft/s)
36-inch, 32 MGD (7 ft/s)
30-inch, 27.2 MGD
35 psi
35 psi
HYDRAULIC GRADE LINE
GROUND PROFILE
City of Oak Creek
City of Franklin
City of Franklin
City of Muskego
City of Muskego
City of New Berlin
City of New Berlin
City of Waukesha
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
0
5
10
15
20



OAK CREEK
PUMP STATION
WAUKESHA CENTRAL
PRESSURE ZONE
Root River
E-1
Lake Michigan Basin
Mississippi River Basin
E-2
F-8
F-9
I-43
C-11
C-12
C-13
C-14
SR 164 and Les Paul Parkway
225 psi
36-inch, 21.0 MGD
30-inch, 27.2 MGD
HYDRAULIC GRADE LINE
35 psi
35 psi
City of Oak Creek
City of Franklin
City of Franklin
City of Muskego
City of Muskego
Town of Vernon
Town of Vernon
City of Waukesha
Elevation (ft)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
0
5
10
15
20
Distance from Supply Connection (mi)



OAK CREEK
PUMP STATION
WAUKESHA CENTRAL
PRESSURE ZONE
225 psi
Root River
E-1
Lake Michigan Basin
Mississippi River Basin
E-2
F-8
F-9
I-43
C-11
C-12
C-13
C-14
SR 164 and Les Paul Parkway
36-inch, 32.0 MGD (7 ft/s)
36-inch, 32.0 MGD (7 ft/s)
30-inch, 27.2 MGD
35 psi
35 psi
35 psi
HYDRAULIC GRADE LINE
City of Oak Creek
City of Franklin
City of Franklin
City of Muskego
City of Muskego
Town of Vernon
Town of Vernon
City of Waukesha
Elevation (ft)
1,400
1,300
1,200
1,100
1,000
900
800
700
600
0
5
10
15
20
Distance from Supply Connection (mi)

Great Lakes Water Supply Program

Great Water Alliance | Task 6-100 Meeting No. 4

Water Supply Facilities Site Selection Meeting

May 23, 2017

GREAT WATER ALLIANCE™

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Meeting Goals and Objectives

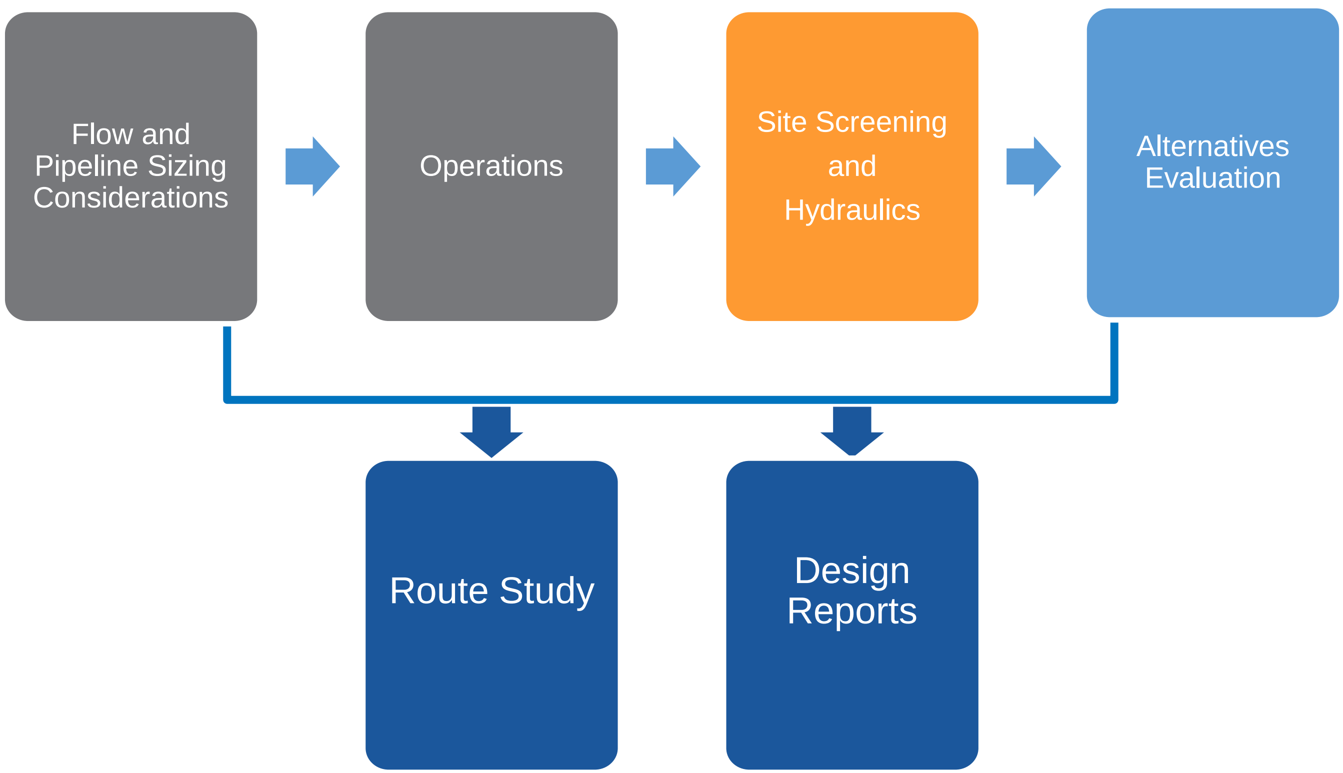
- Understanding of the site screening process
- Understanding of desktop analysis impacts
- Understanding of hydraulic analysis impacts
- Agree upon recommendations for:
  - Water Supply Pumping Station (WSPS)
  - Booster Pumping Station (BPS)
- Discuss possible sites for a Future Booster Pumping Station (FBPS)

Site Screening Overview

Site Screening and Hydraulics

- Performed field reconnaissance - February, 2017
- Identified and reviewed potential sites
- Performed desktop analysis and evaluations
- Performed hydraulic analysis
- Developed recommendations based on the desktop and hydraulic analysis

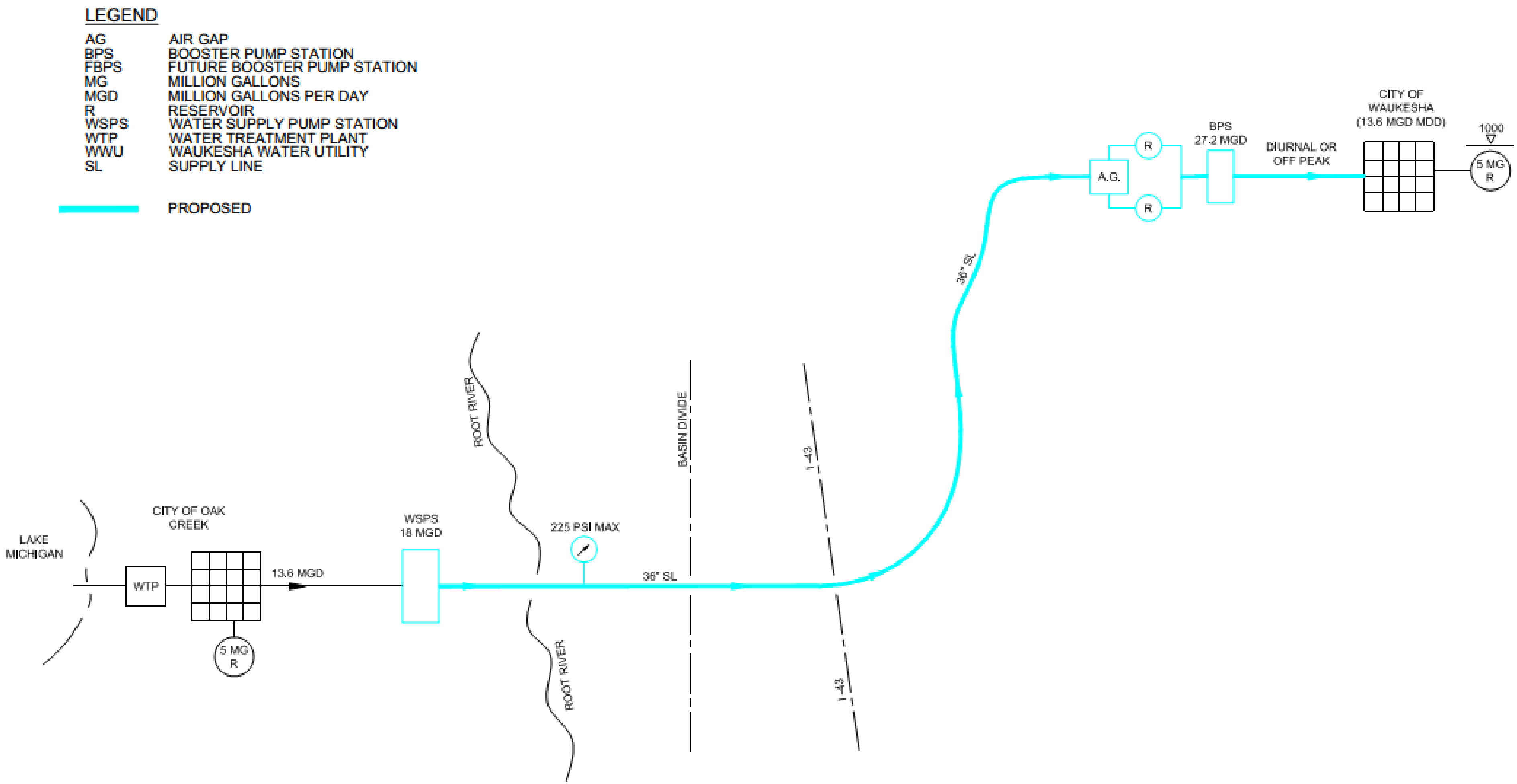
Water Supply Facilities Workplan



Waukesha Water Utility

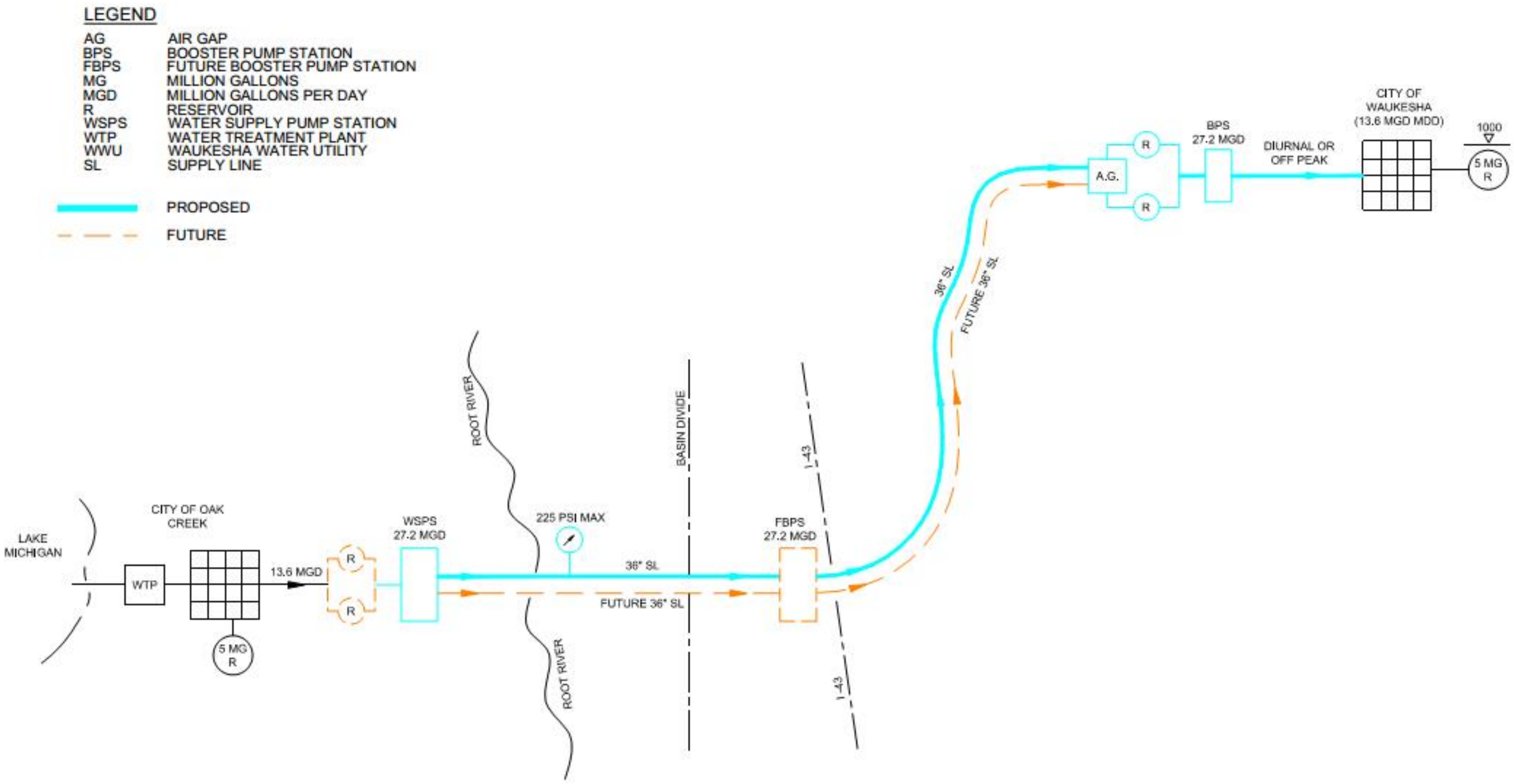
GREELEY AND HANSEN

Water Supply System Diagram



Waukesha Water Utility GREELEY AND HANSEN

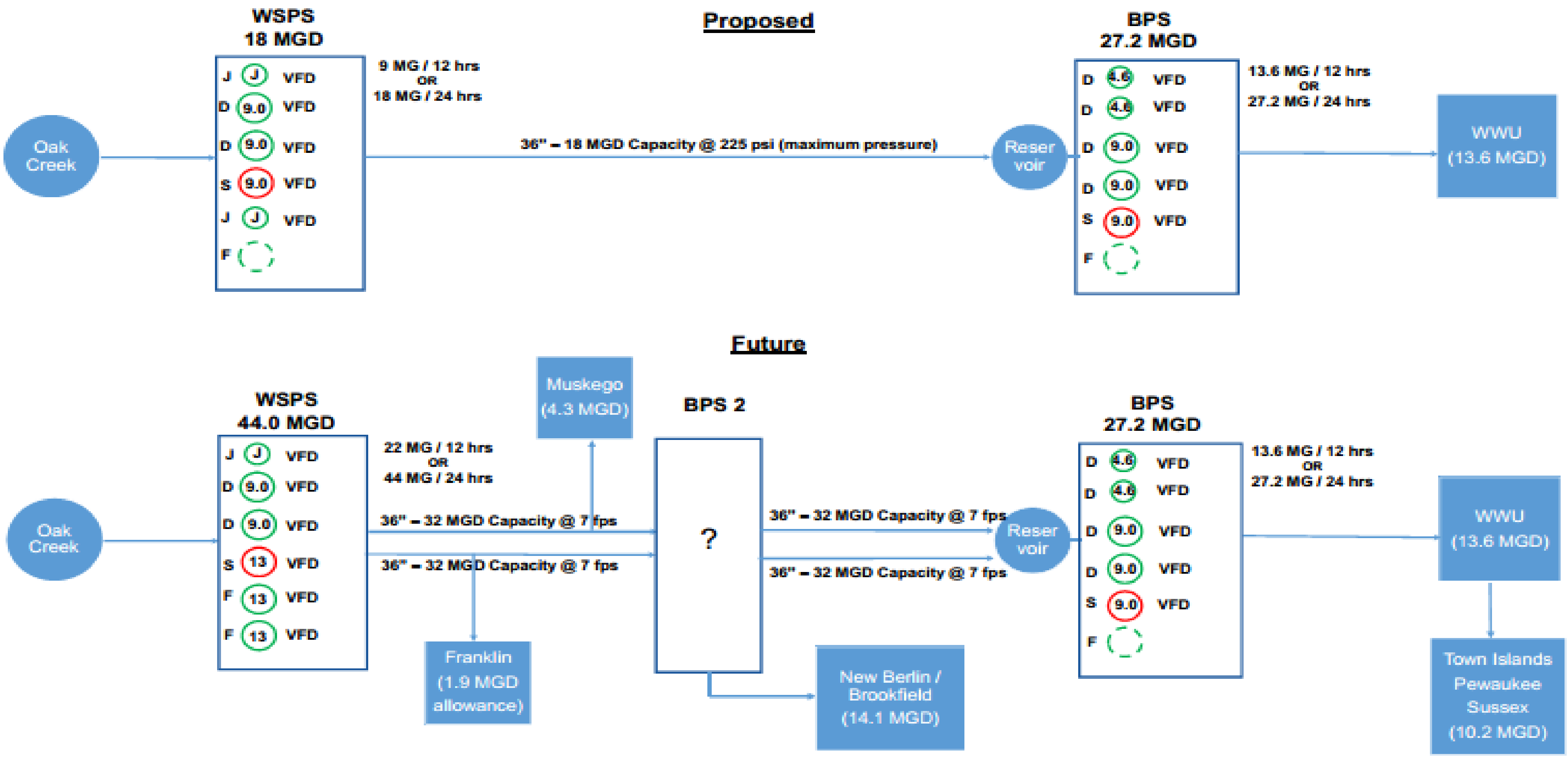
Water Supply System Diagram



Waukesha Water Utility

GREELEY AND HANSEN

Pumping Station Layout



Waukesha Water Utility

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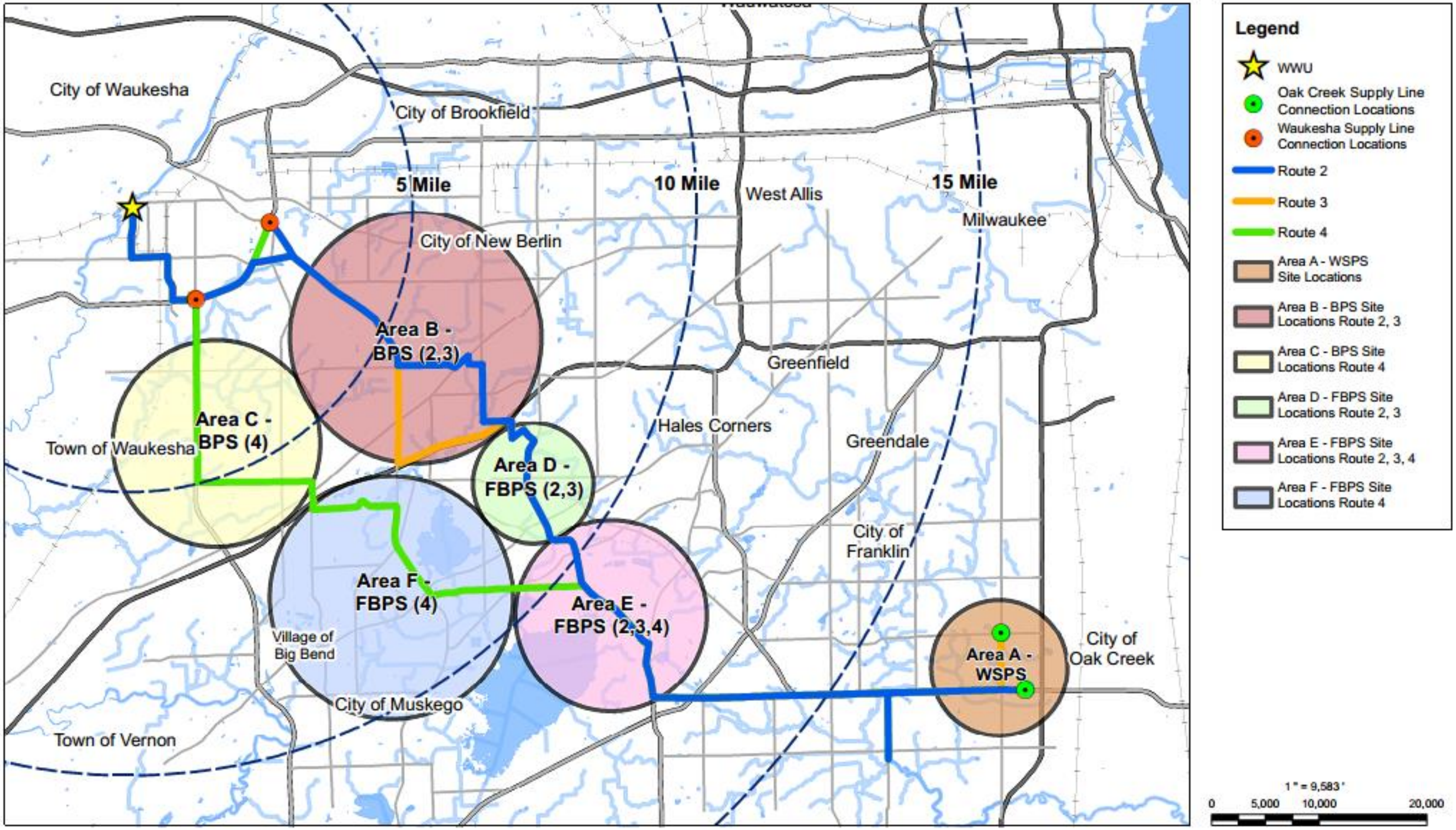
Overall Map



Waukesha Water Utility

GREELEY AND HANSEN

Desktop Analysis

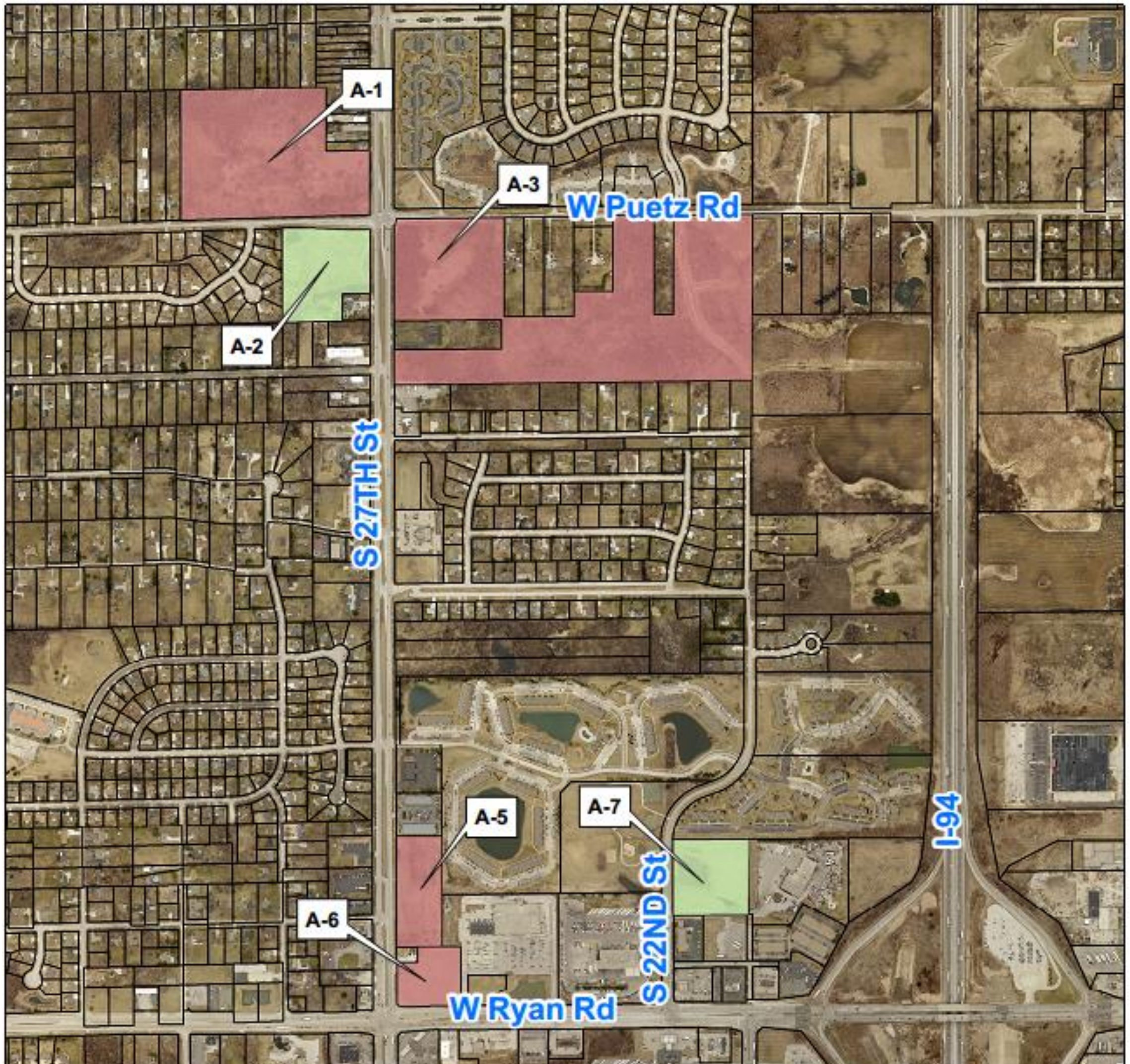
Desktop Analysis Evaluation Criteria

Desktop Analysis Evaluation Criteria

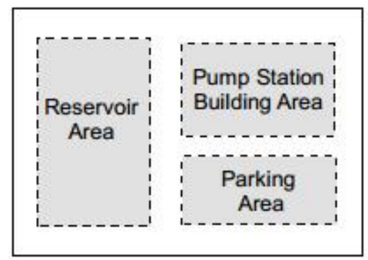
- HAZARDOUS MATERIALS
- ARCHEOLOGICAL
- WETLANDS AND WATERWAYS
- FLOODPLAIN AND FLOODWAY
- SITE SIZE AND ELEVATIONS

WSPS Site Evaluation (All Routes)

HANDOUT NO. 4



Key Map



Conceptual Site Layout
Estimated Acreage 5.0 Acres

Site Number	Acreage
A-1	21.5
A-2	7.4
A-3	53.5
A-5	5.0
A-6	3.7
A-7	5.7

Legend

- ☆ Oak Creek Reservoir
- Recommended Site
- Evaluated Site

WSPS Site Evaluation (All Routes)

Site No.	Hazardous Material	Archeological	Wetlands and Waterways	Floodplain and Floodway	Site Size and Elevations
A-1	◍	○	◍	○	○
A-2	○	○	○	○	○
A-3	◍	○	●	○	○
A-5	◍	○	○	○	●
A-6	●	○	○	○	●
A-7	○	○	○	○	○

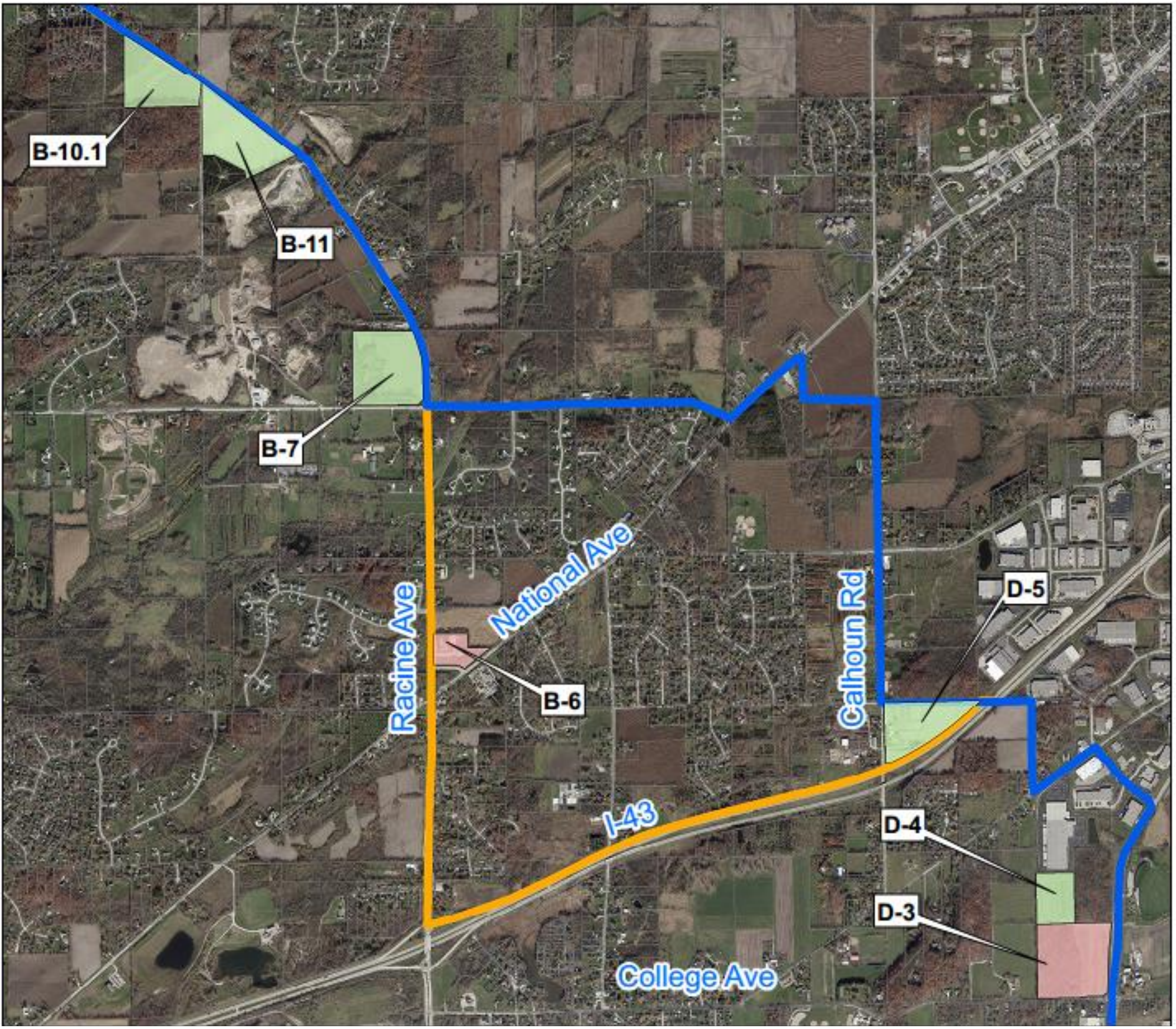
○ No Identified Concerns or Issues

◍ Potential or Minor Issues

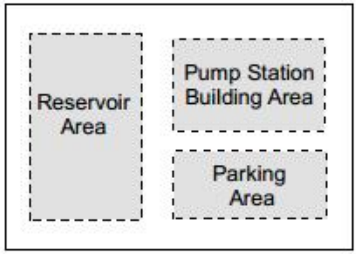
● Identified or Major Issues

BPS Site Evaluation (Routes 2 & 3)

HANDOUT NO. 5



Key Map



Conceptual Site Layout
Estimated Acreage 8.0 Acres

Site Number	Acreage
B-10.1	27
B-11	29
B-7	57
B-6	9
D-5	25
D-4	13
D-3	36

Legend

- Recommended Site
- Evaluated Site

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BPS Site Evaluation (Routes 2 & 3)

Site No.	Hazardous Material	Archeological	Wetlands and Waterways	Floodplain and Floodway	Site Size and Elevations
B-6	●	●	○	○	○
B-7	○	○	○	○	○
B-10.1	TBD	○	●	○	◍
B-11	TBD	○	◍	○	○
D-3	○	○	◍	○	○
D-4	○	○	○	○	○
D-5	○	○	○	○	○

○ No Identified Concerns or Issues

◍ Potential or Minor Issues

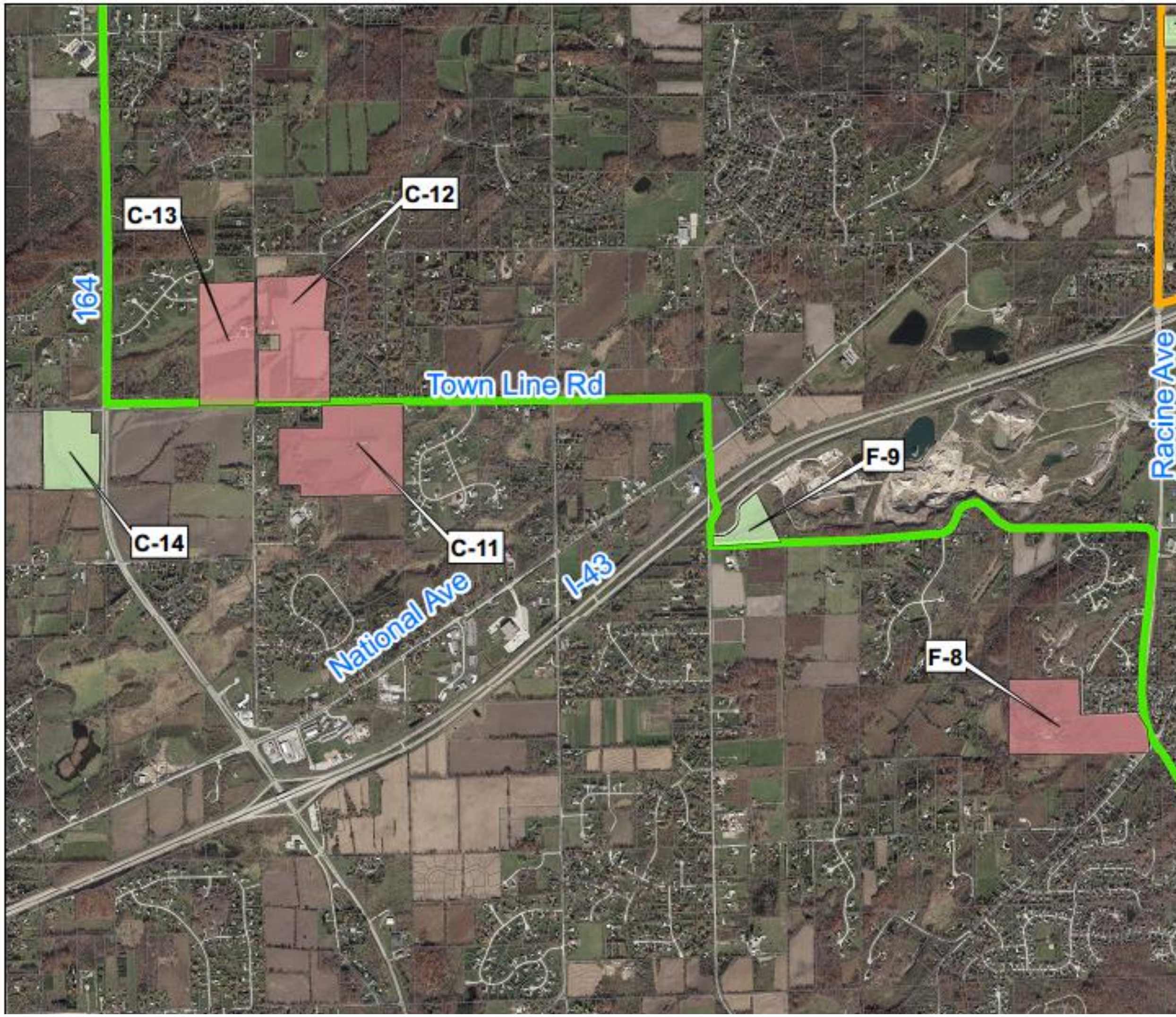
● Identified or Major Issues

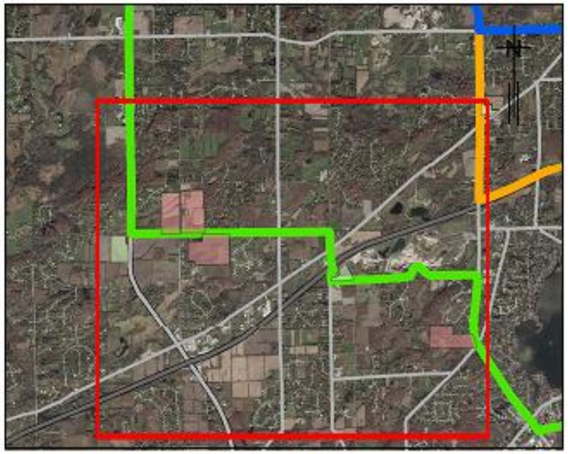
Booster Pumping Station Concept
Site B-10.1

Booster Pumping Station Concept
Site B-10.1

BPS Site Evaluation (Route 4)

HANDOUT NO. 6





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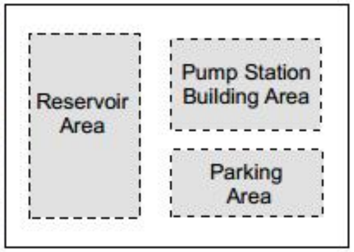


Conceptual Site Layout
Estimated Acreage 8.0 Acres

Site Number	Acreage
F-8	58
F-9	12
C-11	75
C-12	60
C-13	50
C-14	30

Legend

- Recommended Site
- Evaluated Site

Waukesha Water Utility

GREELEY AND HANSEN

BPS Site Evaluation (Route 4)

Site No.	Hazardous Material	Archeological	Wetlands and Waterways	Floodplain and Floodway	Site Size and Elevations
C-11	○	○	◍	○	○
C-12	○	○	◍	○	◍
C-13	●	○	◍	○	○
C-14	○	◍	◍	○	○
F-8	◍	●	●	○	○
F-9	○	○	○	○	○
E-1	◍	◍	◍	●	○
E-2	●	●	○	◍	○

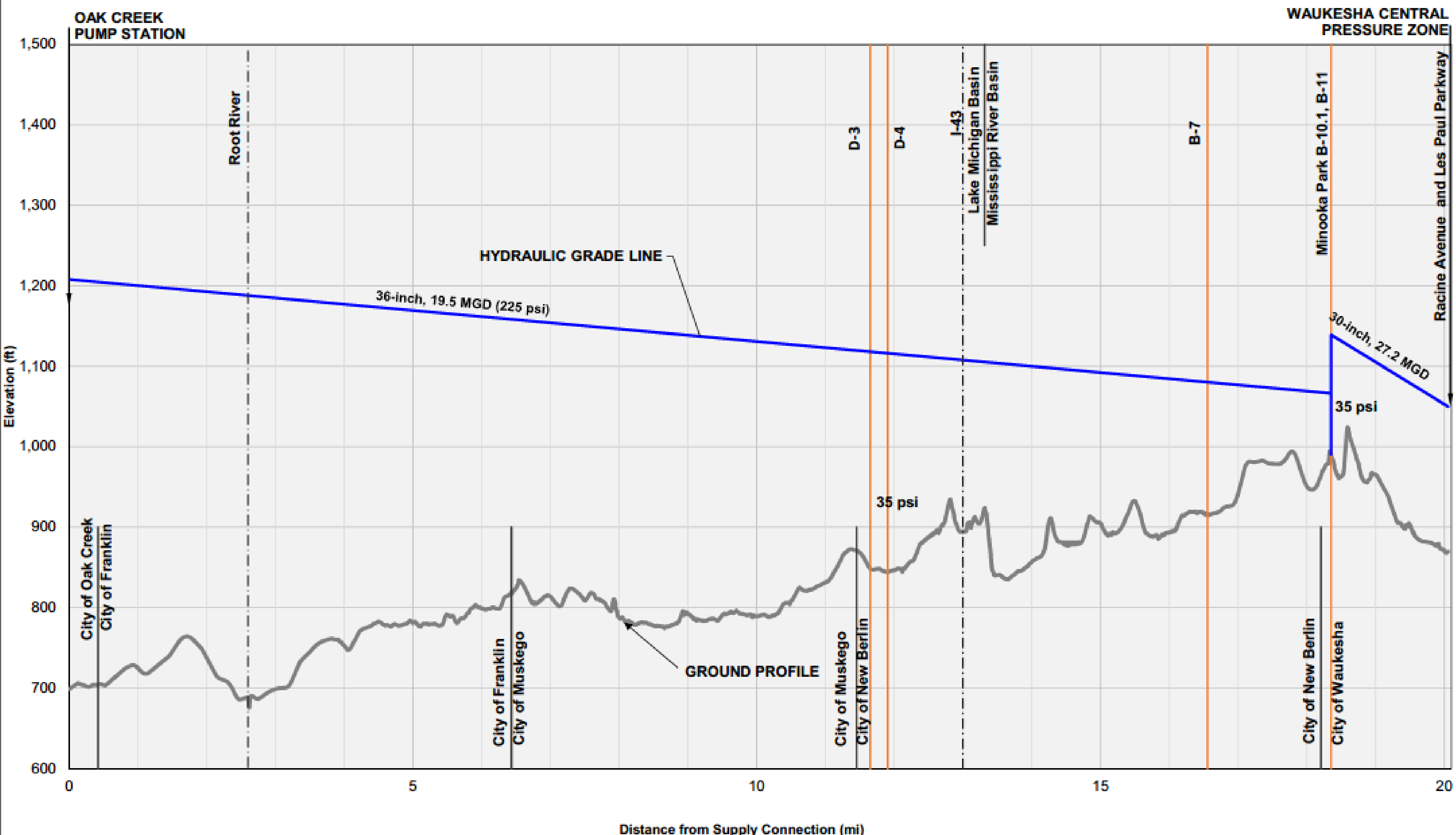
○ No Identified Concerns or Issues
◍ Potential or Minor Issues
● Identified or Major Issues

Hydraulic Analysis

Hydraulic Analysis Assumptions

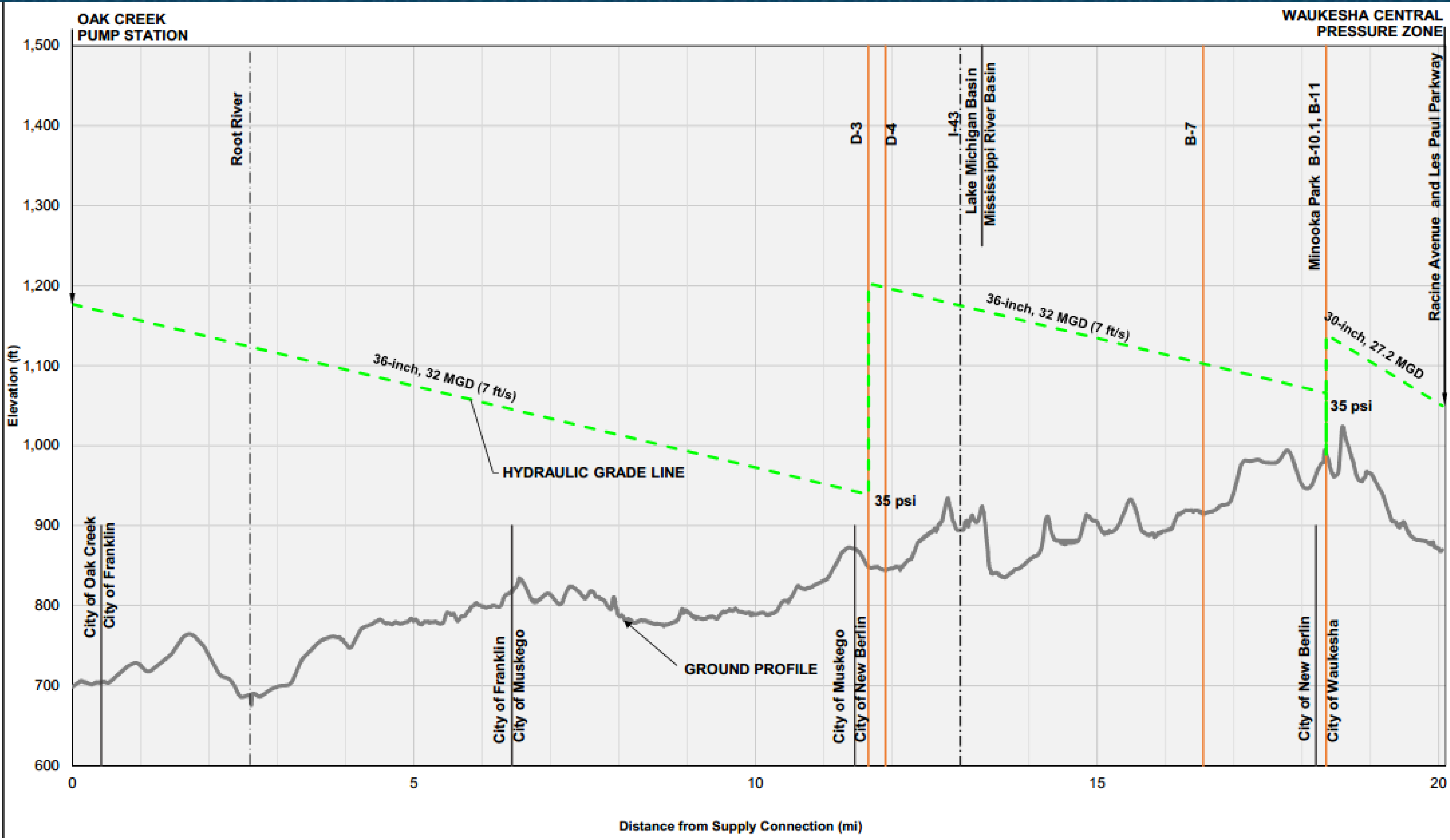
- Velocity
  - Max Velocity 7 fps
- Pressure (psi)
  - Min Operating Pressure 35 psi
  - Max Operating Pressure 225 psi
- Hydraulic Grade
  - HGL at WWU connection is 1,050 ft
    - Pressure to convey flow from connection point to Hillcrest Reservoir at 1,000 ft.

Hydraulic Analysis (Routes 2 & 3)



Waukesha Water Utility GREELEY AND HANSEN

Hydraulic Analysis (Routes 2 & 3)



Waukesha Water Utility

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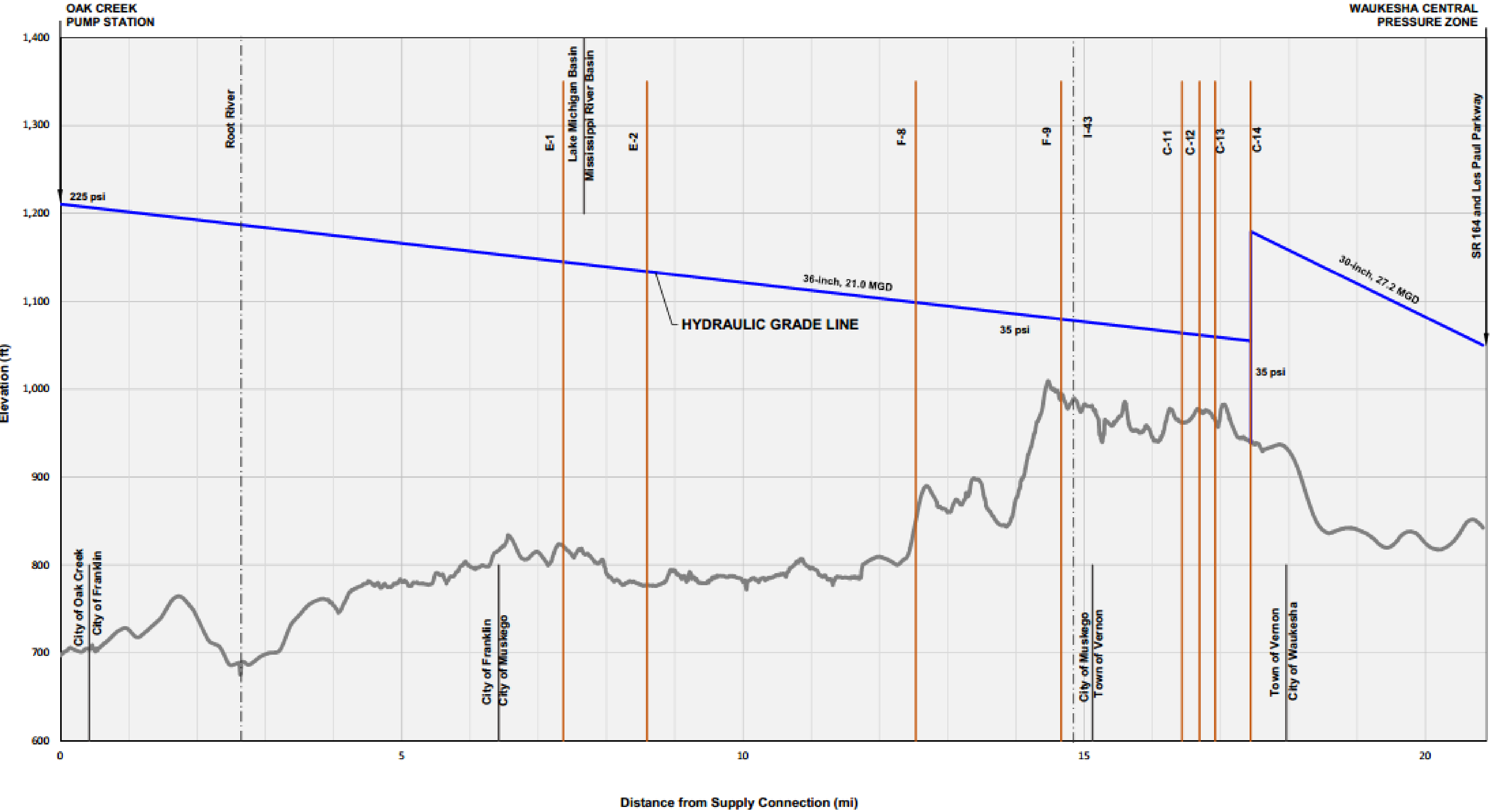
Hydraulic Analysis (Routes 2 & 3)

Booster Pump Station Site Comparison

Minooka Park	Other Sites
Closer to Waukesha (Access and Maintenance)	Further from Waukesha (Access and Maintenance)
Shorter pipe to Waukesha (Risk and Storage)	Longer pipe to Waukesha (Risk and Storage)
HGL~1,000 ft (Bypass around BPS)	HGL<1,000 ft (No Bypass)
Lower pipeline capacity	Higher pipeline capacity

Hydraulic Analysis (Route 4)



Waukesha Water Utility

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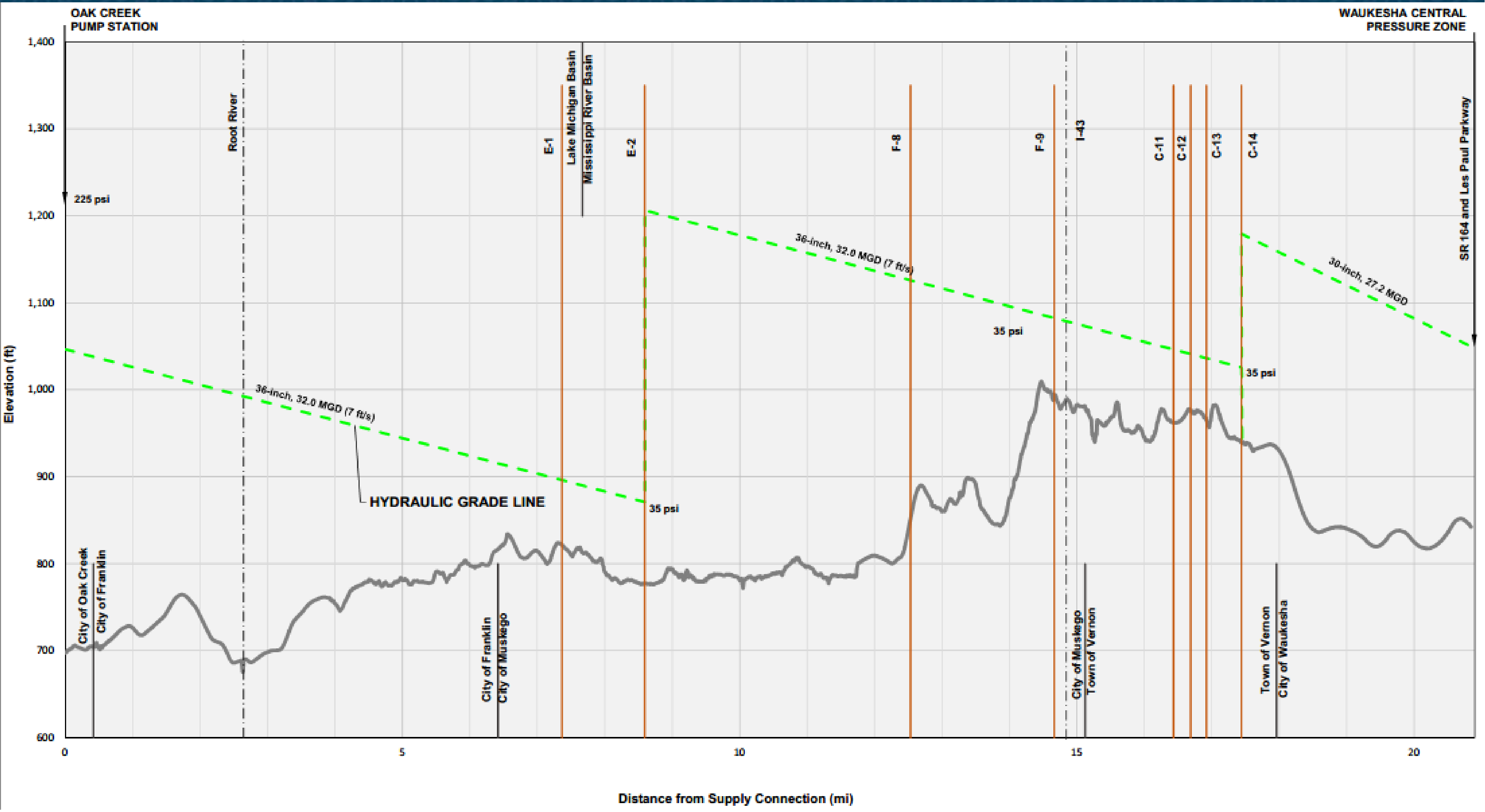
Hydraulic Analysis (Route 4)



Waukesha Water Utility

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Hydraulic Analysis (Route 4)

Booster Pump Station Site Comparison

Sites C-11 to C-14	Other Sites
Closer to Waukesha (Access and Maintenance)	Further from Waukesha (Access and Maintenance)
Shorter pipe to Waukesha (Risk and Storage)	Longer pipe to Waukesha (Risk and Storage)
HGL<1,000 ft (No Bypass)	HGL<1,000 ft (No Bypass)
Lower pipeline capacity	Higher pipeline capacity

Recommendations

Recommendations

- Water Supply Pumping Station (All Routes)
  - Site A-2 (connection at Puetz and 27th)
  - Site A-7 (connection at Ryan and 22nd)
- Booster Pumping Station (Routes 2 & 3)
  - Site B-10.1 (pending further site evaluation)
  - Site B-11 (alternate)
- Booster Pumping Station (Route 4)
  - Site C-14
  - Site F-9 (alternate)

Summary Wrap-Up and Action Items

Summary

- Understanding of the site screening process
- Understanding of desktop impacts to potential sites
- Understanding of hydraulic impacts to potential sites
- Agreed upon recommendations for:
  - Water Supply Pumping Station (WSPS)
  - Booster Pumping Station (BPS)
- Discussed possible sites for a Future Booster Pumping Station (FBPS)

Next Steps

- Alternatives Evaluation
  - Envision aspects
- Continue to evaluate recommended sites and facilities for the Route 2 & 3 Booster Pumping Station
- Decision on Supplier
  - Further site screening as required
- Prepare information to support Route Study and Design Reports

THANK YOU

Waukesha Water Utility
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GREELEY AND HANSEN

SUMMARY

The Great Lakes Water Supply Program Booster Pumping Station (BPS) Operation and Discharge Pipeline Evaluation Meeting was held at the WWU Large Conference Room at 9:00 AM on August 2, 2017. The purpose of the meeting was to present the BPS Operational Alternatives and gain consensus on the preferred alternative. BPS Discharge Pipeline Alternatives were also discussed to gain consensus on recommendations to further evaluate in conjunction with the distribution system modeling efforts.

The attendees are listed on the attached sign-in sheet. The agenda and presentation materials are also attached. The actions items are summarized in the table below.

Action Item		Action By	Due Date
1.	Review Well 8 reservoir and BPS in the model for errors that might cause low pressure	T. Bluver	**8/31/17**
2.	Evaluate a connection to the system at Les Paul and Sunset	T. Bluver	**8/31/17**
3.	Evaluate modifications to Hillcrest Reservoir	L. Melcher	**8/31/17**
4.	Further evaluate connecting BPS discharge to Southeast Zone controlled by Hunter Elevated Storage Tank	L. Melcher	**8/31/17**
5.	Coordinate with CH2M on scenarios to be modeled and potential system connection locations	L. Melcher / T. Bluver	**9/15/17**

1) Welcome
   a) The agenda and meeting objectives were discussed.
   b) The work recently performed was discussed.

2) Overview
   a) A recap of the work performed in conjunction with this meeting was discussed.
   b) The evaluation boundary conditions and assumptions were presented.

3) BPS Operational Alternatives
   a) BPS Operational Alternatives for Routes 2, 3, and 4 were presented.
      i) A hydropneumatic tank is not preferred for pressure control. A hydropneumatic tank can be utilized if more preferable alternatives do not exist.
      ii) Any pressure reducing valves (PRVs) will be located above grade in a building or structure. The valves need to be accessible without confined space access.
   b) Discussion was held about potentially tying into the Hunter Elevated Storage Tank as a control element for the BPS. This would also ensure pressure is maintained on the discharge line from the BPS. GH will continue to evaluate this control strategy.

4) BPS Discharge Pipeline Evaluation
   a) Discharge Pipeline Alternatives were presented.

b) The results of the evaluation will be used to provide input for modeling distribution system scenarios.
c) Common corridors will be considered when evaluating potential connection locations.
d) The Well 8 area of the model will be reviewed to determine how the reservoir was operating in this model.
e) GH will perform a model run that connects the BPS discharge pipeline to water main at Sunset and Les Paul.
f) GH will continue to evaluate modifications to Hillcrest Reservoir.

5) Summary Wrap-up and Next Steps

a) The preferred BPS Operational Alternatives were confirmed for Routes 2, 3, and 4.
b) The potential BPS discharge pipeline configurations were discussed.
c) Action items are summarized in the table on Page 1 of this summary.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

Date/Time: August 2, 2017, 9:00 a.m. – 10:30 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Ted Bluver, GH
Lee Melcher, GH
Mike Pekkala, GH
Katie Richardson, GH
Nicole Spieles, GH
Tom Wilson, GH
Kevin Richardson, KRC

Time	Topic	Presenter(s)
9:00 a.m.	Welcome – Agenda Overview (Handout) – Meeting Objectives – Key Work Recently Performed	Nicole Spieles; Lee Melcher
9:05 a.m.	Overview – Recap – Boundary Conditions and Assumptions	Lee Melcher
9:20 a.m.	BPS Operational Alternatives – Route Alternatives 2 and 3 – Route Alternative 4	Mike Pekkala
10:00 a.m.	BPS Discharge Pipeline Evaluation	Ted Bluver; Tom Wilson
10:25 a.m.	Summary Wrap-up and Next Steps	Nicole Spieles
10:30 a.m.	Adjourn	

GREAT WATER
ALLIANCE

BPS OPERATION AND DISCHARGE PIPELINE EVALUATION MEETING
SIGN-IN SHEET

August 2, 2017

No.	Name	Company	Initial
1	Dan Duchniak	Waukesha Water Utility	[redacted]
2	Kelly Zylstra	Waukesha Water Utility	[redacted]
3	Nicole Spieles	Greeley and Hansen	[redacted]
4	Katie Richardson	Greeley and Hansen	[redacted]
5	Thomas Wilson	Greeley and Hansen	[redacted]
6	Mike Pekkala	Greeley and Hansen	[redacted]
7	Lee Melcher	Greeley and Hansen	[redacted]
8	Ted Bluver	Greeley and Hansen	[redacted]
9	Kevin Richardson	Kevin Richardson Consulting	[redacted]
10			
11			
12			

Great Lakes Water Supply Program

Great Water Alliance | Task 6-100 Meeting No. 7

BPS Operation and Discharge Pipeline Evaluation Meeting

August 2, 2017

GREAT WATER ALLIANCE

GREELEY AND HANSEN

Meeting Objectives

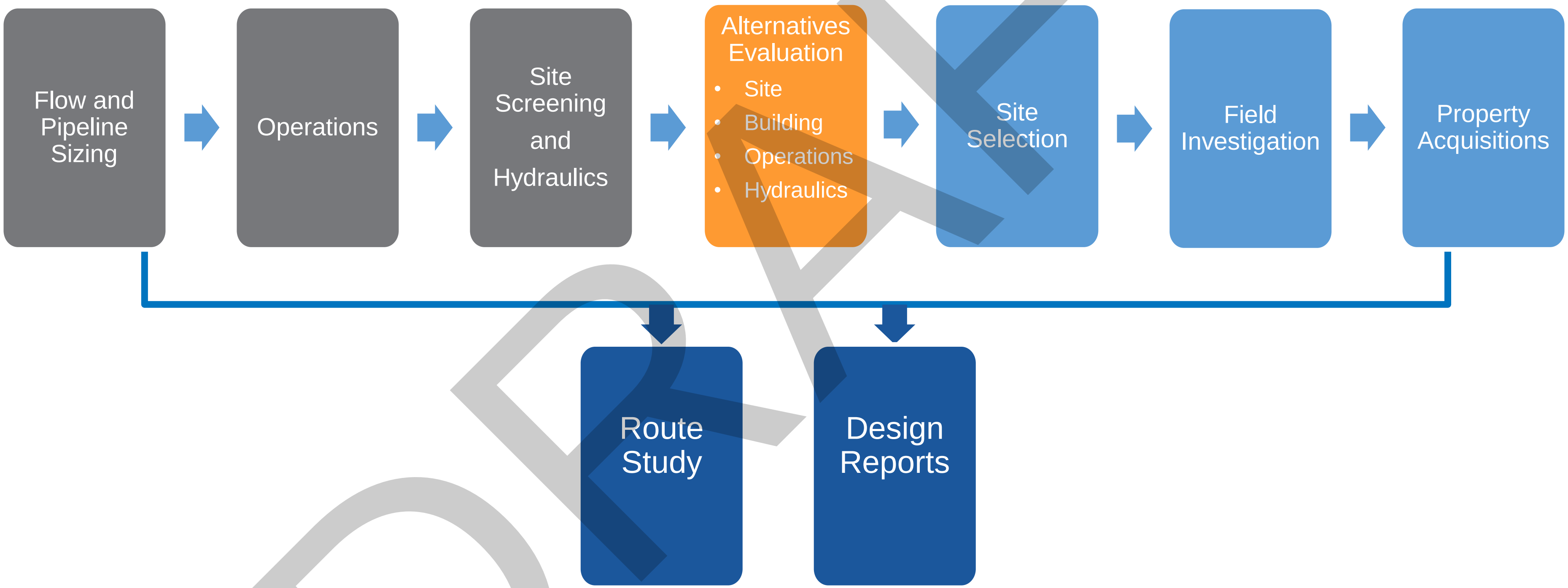
- Confirm Preferred Booster Pumping Station (BPS) Operational Configuration for Route Alternatives 2, 3, and 4, including:
  - Alternatives identified; and,
  - Preferred configuration.
- Discuss Potential BPS Discharge Pipeline Configurations, including:
  - Alternatives identified; and,
  - Next steps for evaluation.
- Support Development of Distribution System Modeling Scenarios.

Key Work Recently Performed

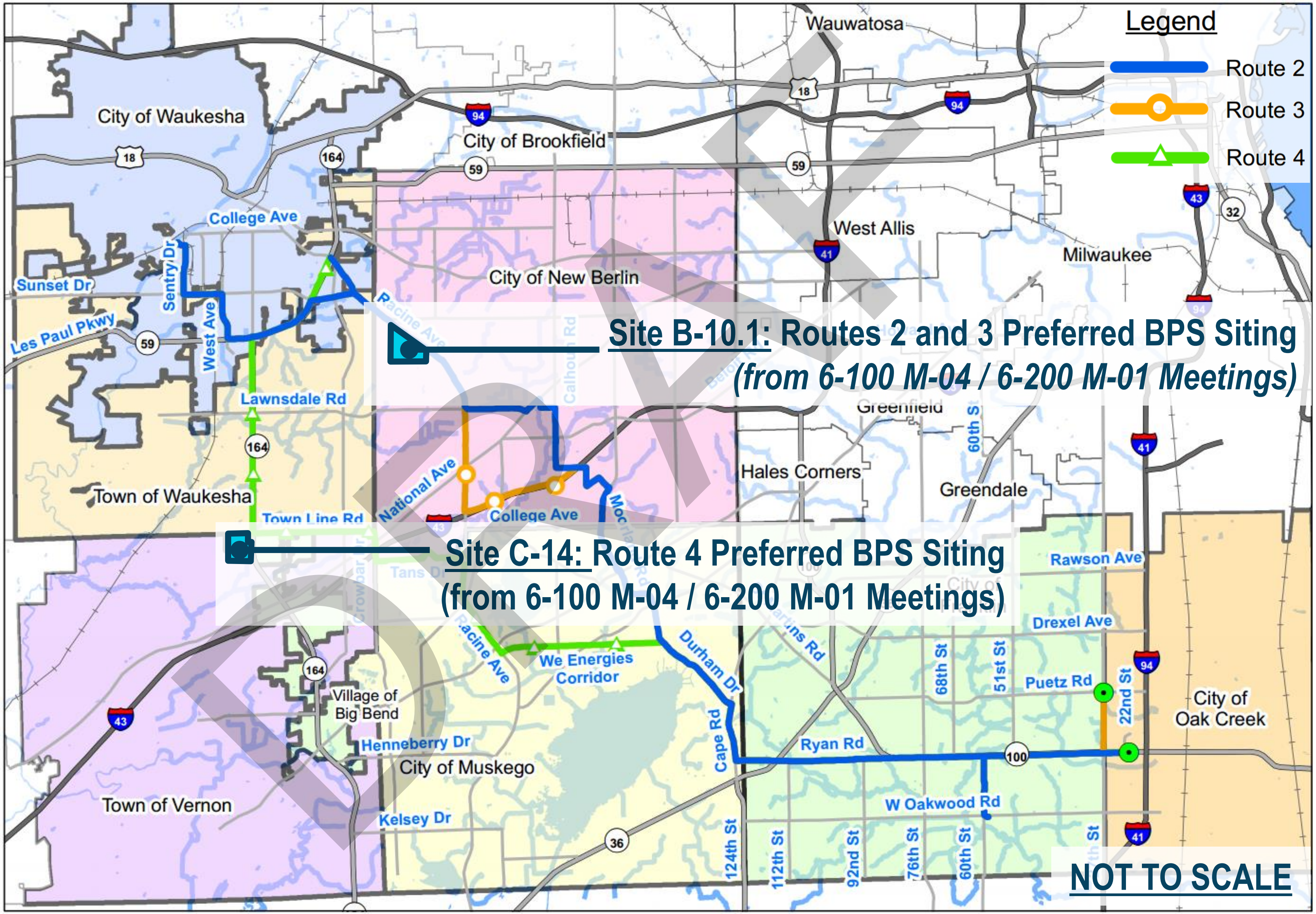
- Identified BPS Operational Alternatives and Discharge Pipeline Alternatives
- Updated Geometry in 2012 InfoWater Distribution System Model (Model)
- Built Alternatives into Model
- Performed Extended Period Simulations to Evaluate Alternatives
- Developed Comparative Capital Costs
- Compared Alternatives Based on Economic and Non-Economic Criteria
- Identified Preferred BPS Operational Alternative and Discharge Pipeline Alternatives

Overview

Overview: Recap



Overview: Recap



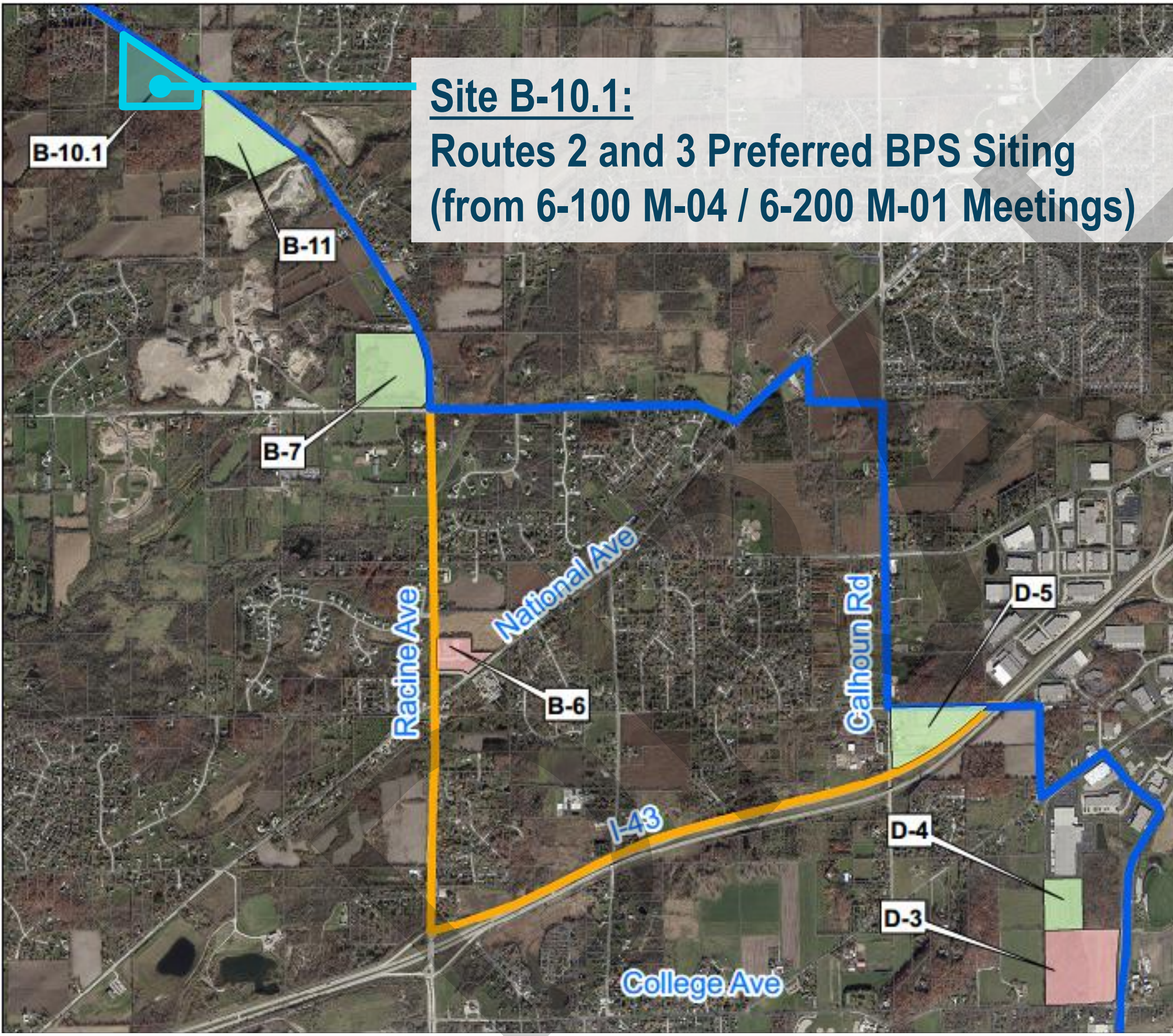
Overview: Boundary Conditions and Assumptions

- Boundary Conditions:
  - Minimum design pressure, 35 psi
  - Minimum allowable pressure, 20 psi
  - Hillcrest Reservoir:
    - Operates between levels of 19 and 25 feet (HGL of 994 to 999 feet)
    - High water level cannot be raised
    - Modified to allow fill and drain from new water supply
- Assumptions:
  - Existing booster pumps and valves remain online with 2012 logic maintained
  - BPS off-peak pumping was not considered

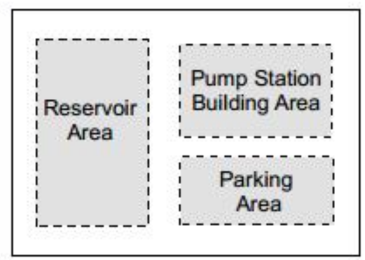
BPS Operational Alternatives

BPS Operational Alternatives: Route Alternatives 2 and 3

HANDOUT NO. 5



Key Map



Conceptual Site Layout
Estimated Acreage 8.0 Acres

Site Number	Acreage
B-10.1	27
B-11	29
B-7	57
B-6	9
D-5	25
D-4	13
D-3	36

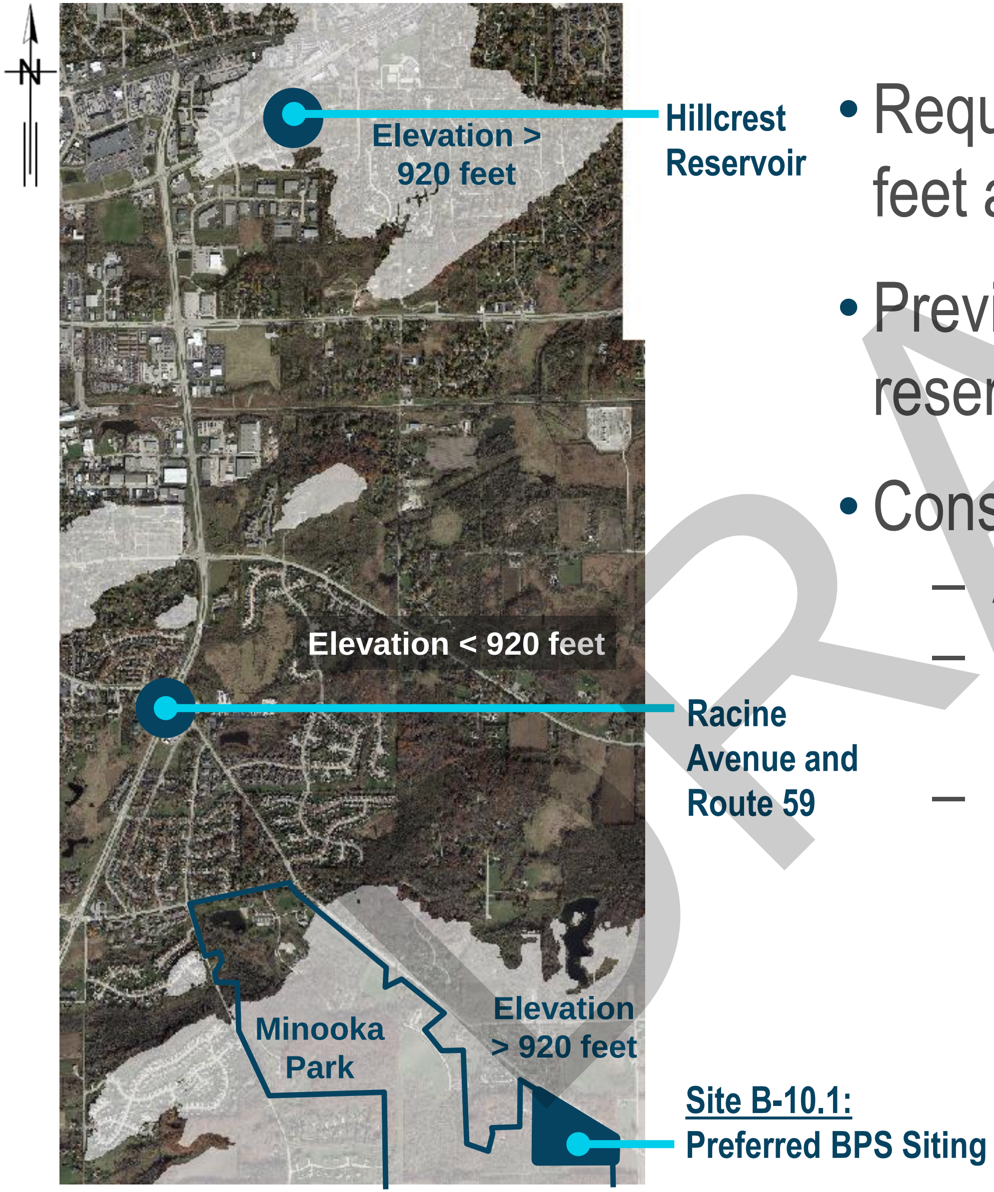
Legend

- Recommended Site
- Evaluated Site

Waukesha Water Utility

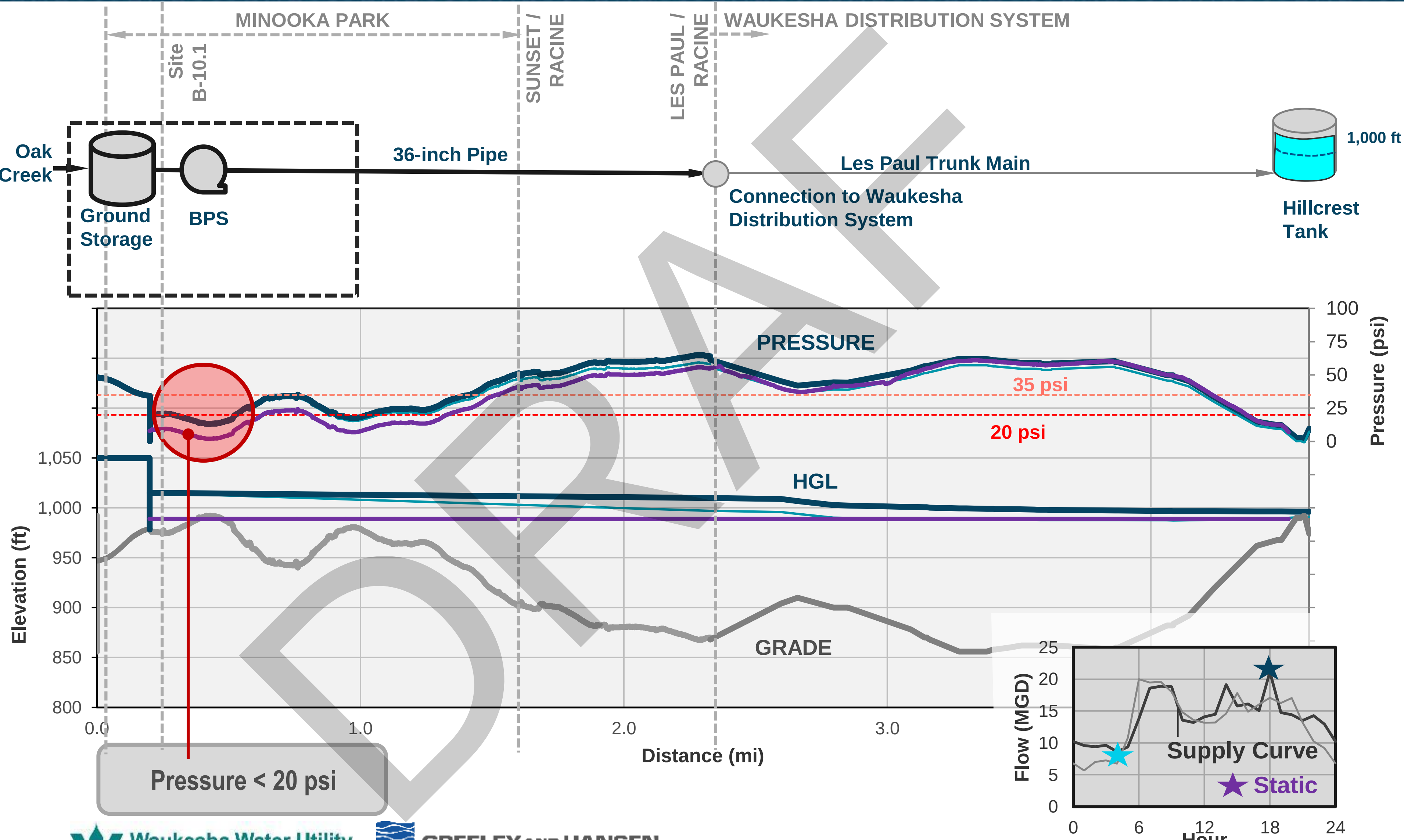
GREELEY AND HANSEN

BPS Operational Alternatives: Route Alternatives 2 and 3



- Require grade elevation below 920 feet along pipeline to maintain 35 psi
- Previously discussed BPS with reservoir at Minooka Park
- Considerations:
  - Alternative approaches
  - Opportunities to minimize infrastructure
  - Utilizing available modeling tools to evaluate alternatives

BPS Operational Alternatives: Route Alternatives 2 and 3
Alternative 2/3-A – With BPS



Waukesha Water Utility

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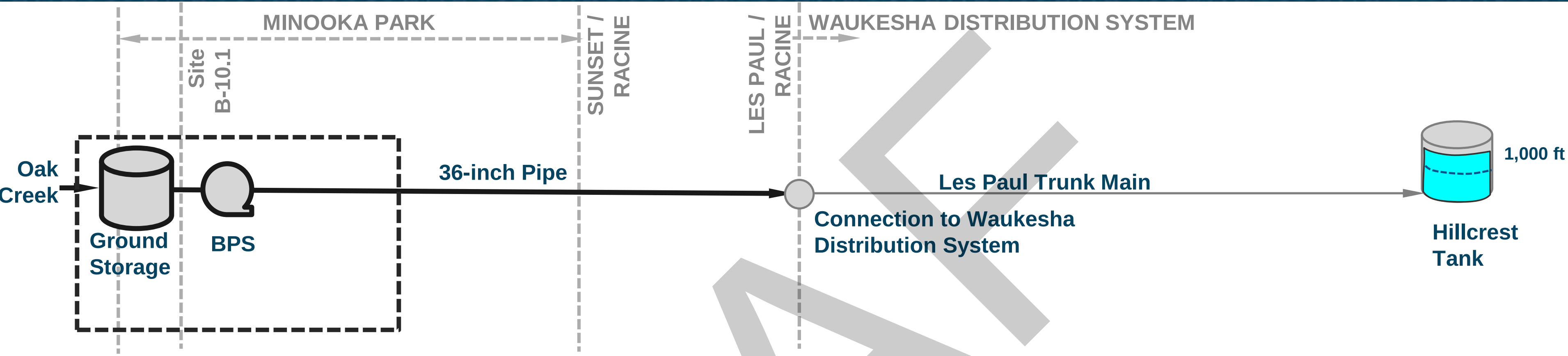
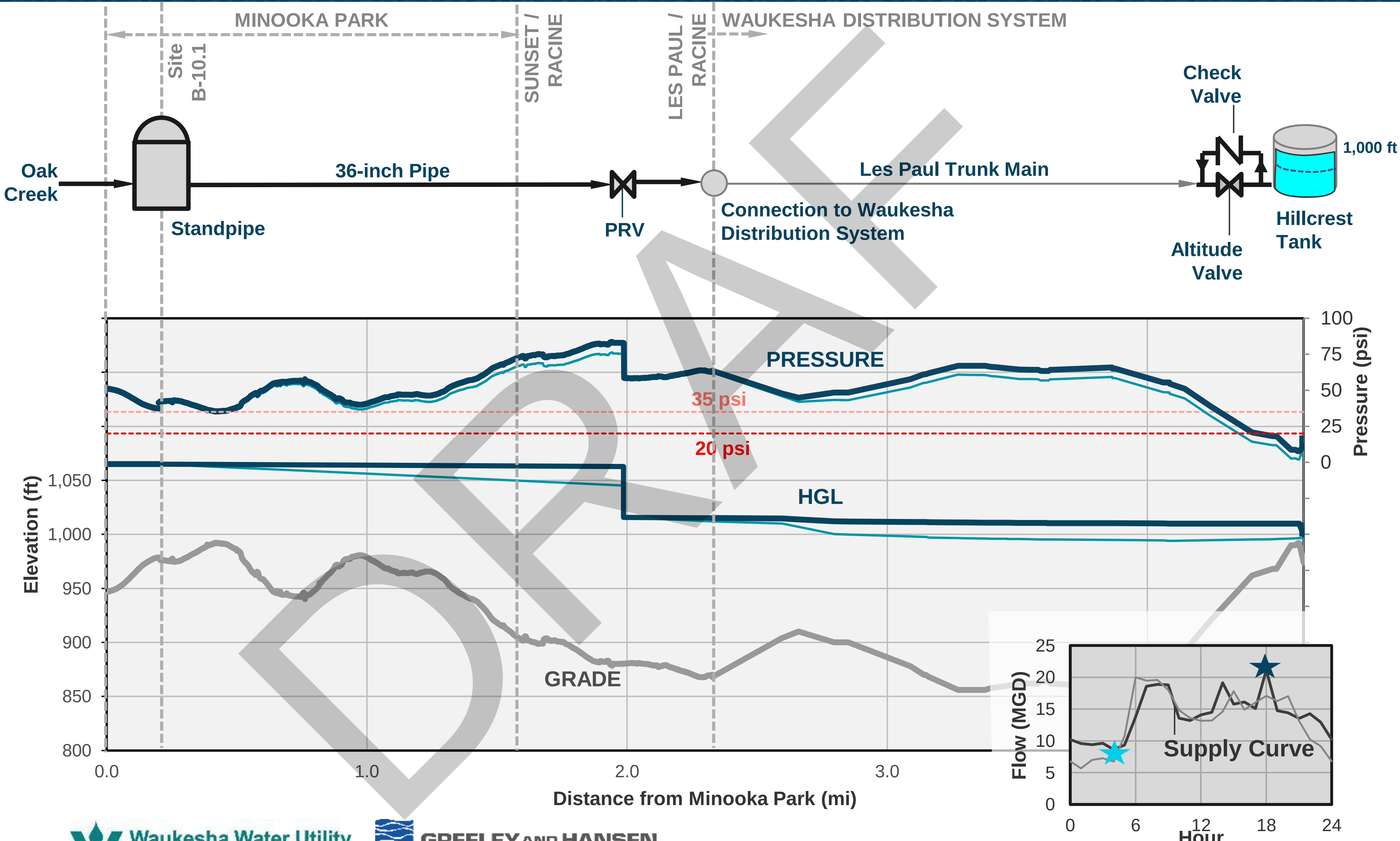
BPS Operational Alternatives: Route Alternatives 2 and 3 Alternative 2/3-A – With BPS

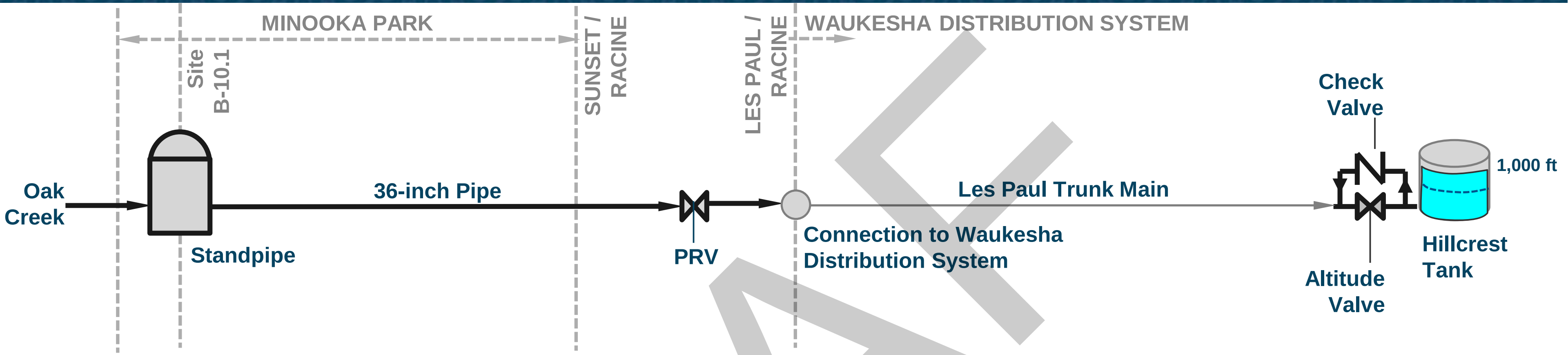


PROS	CONS
• Lower capital cost	• <u>**Permitting barrier - Pressures below 20 psi**</u>
• Operational flexibility	• Higher energy required
• Operational simplicity	
• Typical application	

BPS Operational Alternatives: Route Alternatives 2 and 3
Alternative 2/3-B – No BPS

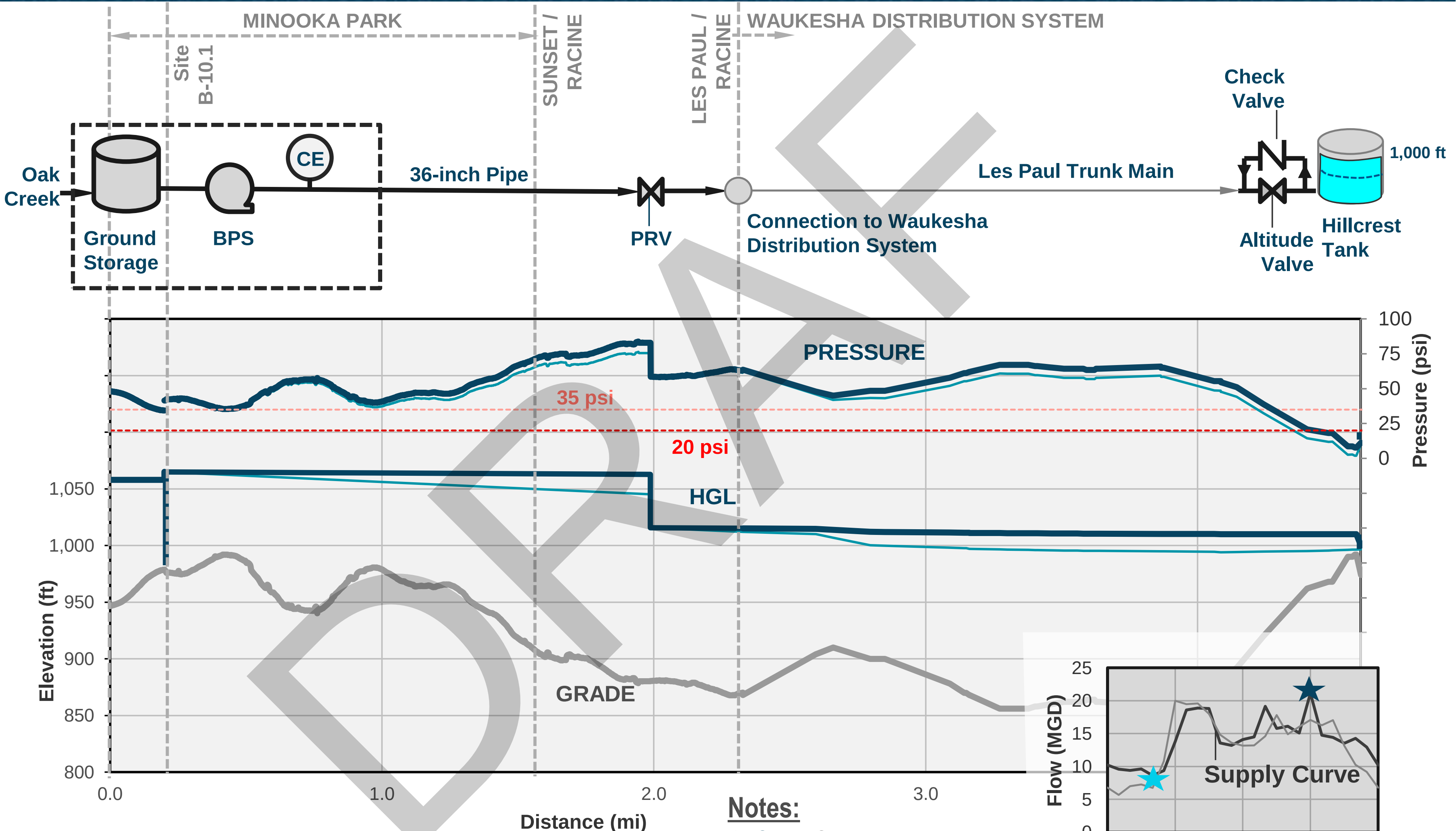


BPS Operational Alternatives: Route Alternatives 2 and 3 Alternative 2/3-B – No BPS



PROS	CONS
• Operational simplicity • Lower energy required • Lower risk of pressures below 20 psi	• Higher capital cost • Lack of operational flexibility • Atypical application (unforeseen design challenges) • Height (not preferred by Waukesha County Department of Parks and Land Use) • Water age

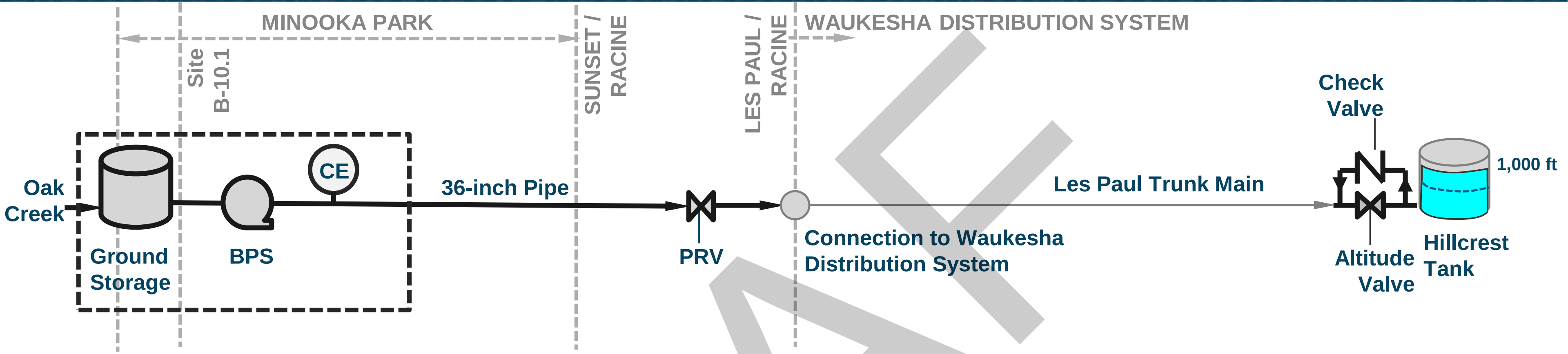
BPS Operational Alternatives: Route Alternatives 2 and 3
Alternative 2/3-C – BPS and PRV



Notes:

1. **CE** = Control element (pressure or elevated storage)

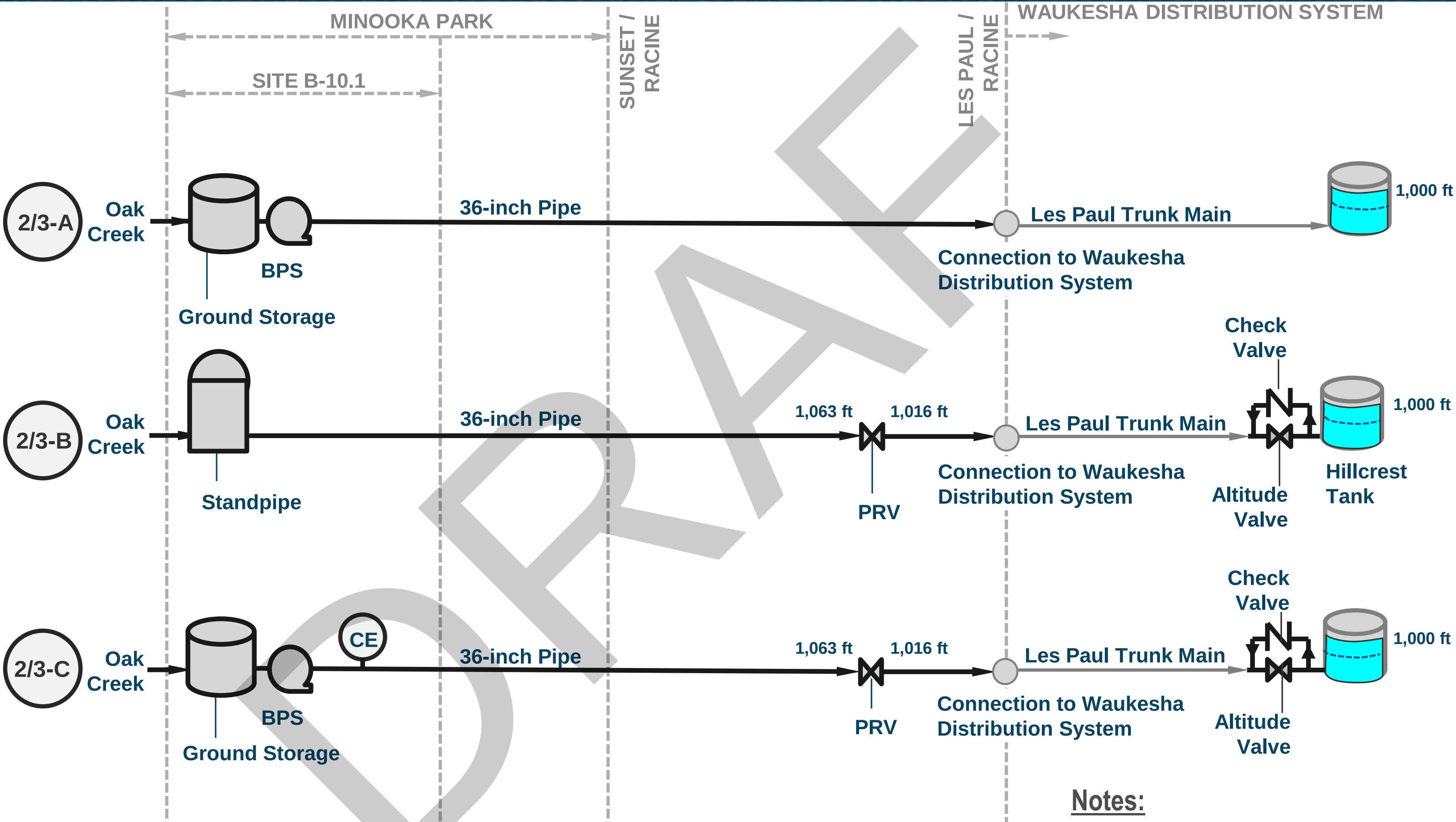
BPS Operational Alternatives: Route Alternatives 2 and 3
Alternative 2/3-C – BPS and PRV



PROS	CONS
• Lower capital cost	• Higher energy required
• Operational flexibility	• Higher operational complexity
• Typical application	
• Lower risk of pressures below 20 psi	

Notes:
1. **CE** = Control element
(pressure or elevated storage)

BPS Operational Alternatives: Route Alternatives 2 and 3



Notes:

1. **CE** = Control element (pressure or elevated storage)

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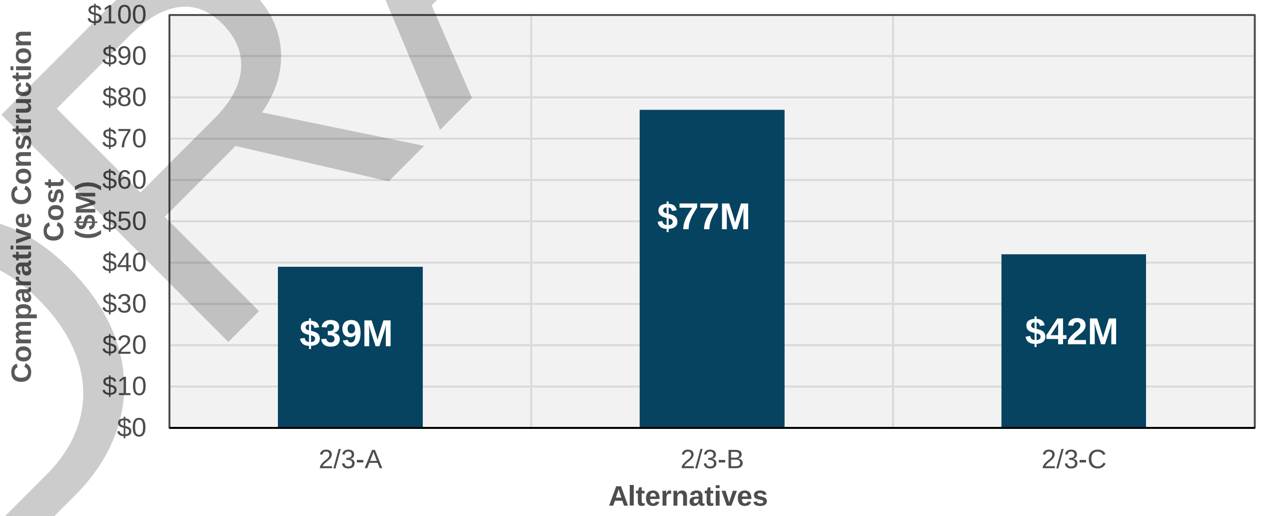
BPS Operational Alternatives: Route Alternatives 2 and 3

Routes 2/3: BPS Operational Alternatives Evaluation			
	BPS Operational Alternatives ($M)		
Evaluation Item	2/3-A	2/3-B	2/3-C
Comparative Construction Cost	39	77	42

Notes:
1. Comparative Construction Costs are presented in June 2017 dollars and include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.



BPS Operational Alternatives: Route Alternatives 2 and 3

Routes 2/3: BPS Operational Alternatives Evaluation			
	BPS Operational Alternatives ($M)		
Evaluation Item	2/3-A	2/3-B	2/3-C
Comparative Construction Cost	39	77	42
Risk of Pressures < 20 psi	More	Less	Less
Typical Application	More	Less	More
Operational Flexibility	More	Less	More
Operational Simplicity	More	More	Less
Potential for Lower Energy Usage	Less	More	Less

Notes:

1. Comparative Construction Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
2. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Alternative 2/3-A is less preferable due to the risk of pressures below 20 psi and its ability to be permitted

BPS Operational Alternatives: Route Alternatives 2 and 3

Routes 2/3: BPS Operational Alternatives Evaluation			
	BPS Operational Alternatives ($M)		
Evaluation Item	2/3-A	2/3-B	2/3-C
Comparative Construction Cost	39	77	42
Risk of Pressures < 20 psi	More	Less	Less
Typical Application	More	Less	More
Operational Flexibility	More	Less	More
Operational Simplicity	More	More	Less
Potential for Lower Energy Usage	Less	More	Less

Notes:

1. Comparative Construction Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
2. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Alternative 2/3-B is less preferable due to cost, unforeseen design challenges, less operational flexibility, height not preferred by Waukesha County Department of Parks and Land Use, and higher water age

BPS Operational Alternatives: Route Alternatives 2 and 3

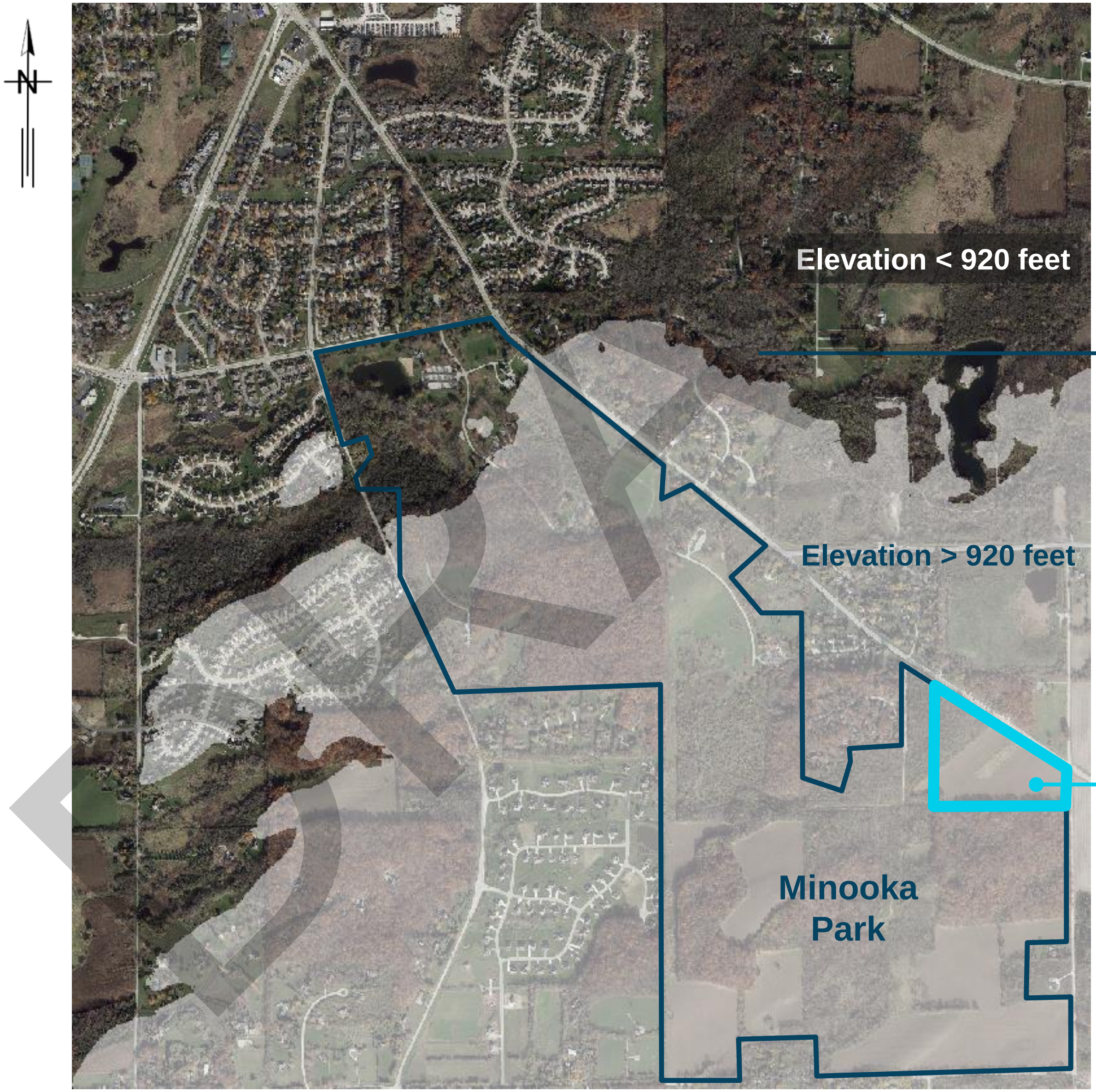
Routes 2/3: BPS Operational Alternatives Evaluation			
	BPS Operational Alternatives ($M)		
Evaluation Item	2/3-A	2/3-B	2/3-C
Comparative Construction Cost	39	77	42
Risk of Pressures < 20 psi	More	Less	Less
Typical Application	More	Less	More
Operational Flexibility	More	Less	More
Operational Simplicity	More	More	Less
Potential for Lower Energy Usage	Less	More	Less

Notes:

1. Comparative Construction Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
2. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Alternative 2/3-C is more preferable

BPS Operational Alternatives: Route Alternatives 2 and 3



To eliminate PRV, elevation below 920 feet is required

Site B-10.1:
Preferred BPS Siting

BPS Operational Alternatives: Route Alternatives 2 and 3

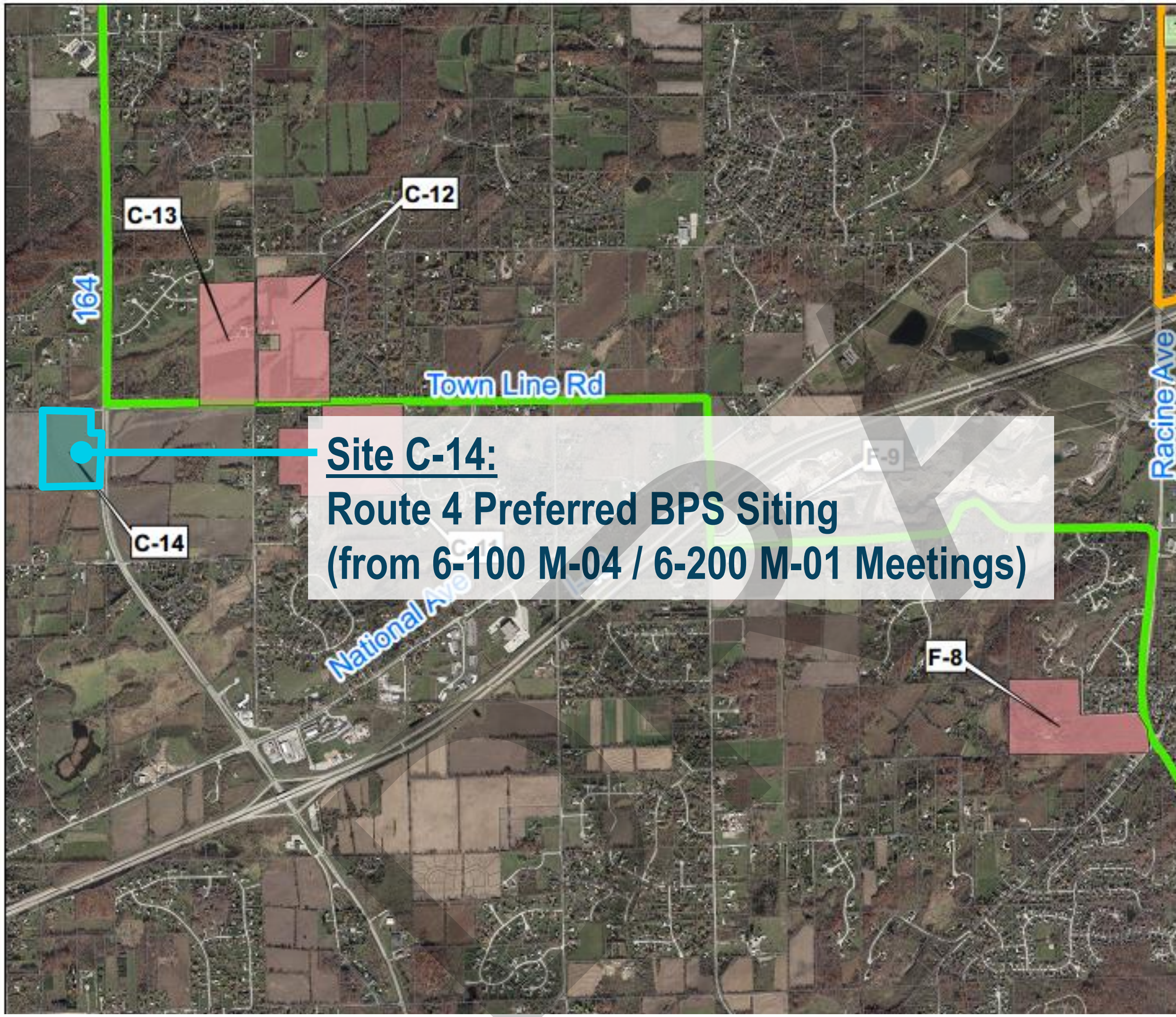
No preferable locations exist in proximity to corridor that will allow for elimination of the PRV

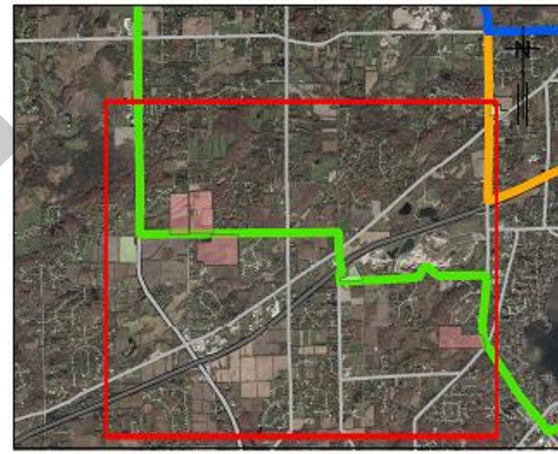
Minimal space available north of Racine Avenue and Sunset Drive

One 5-6-acre site exists near corridor, but not preferred by Waukesha County Department of Parks and Land Use

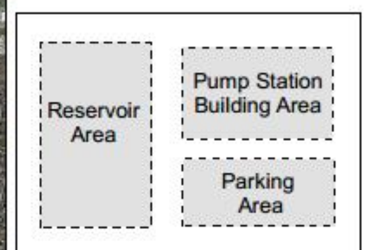
BPS Operational Alternatives: Route Alternative 4

HANDOUT NO. 6





Key Map



Conceptual Site Layout
Estimated Acreage 8.0 Acres

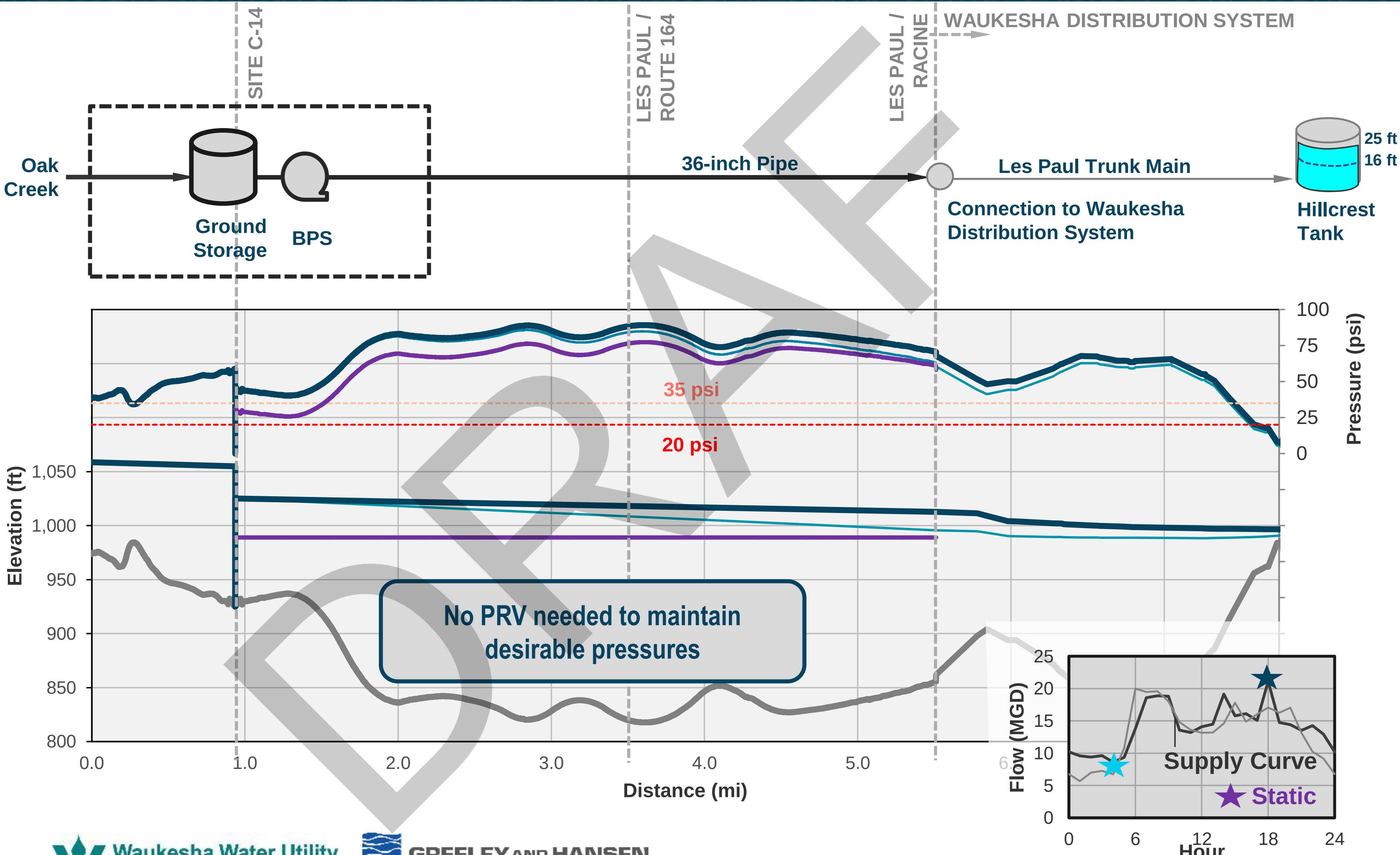
Site Number	Acreage
F-8	58
F-9	12
C-11	75
C-12	60
C-13	50
C-14	30

Legend

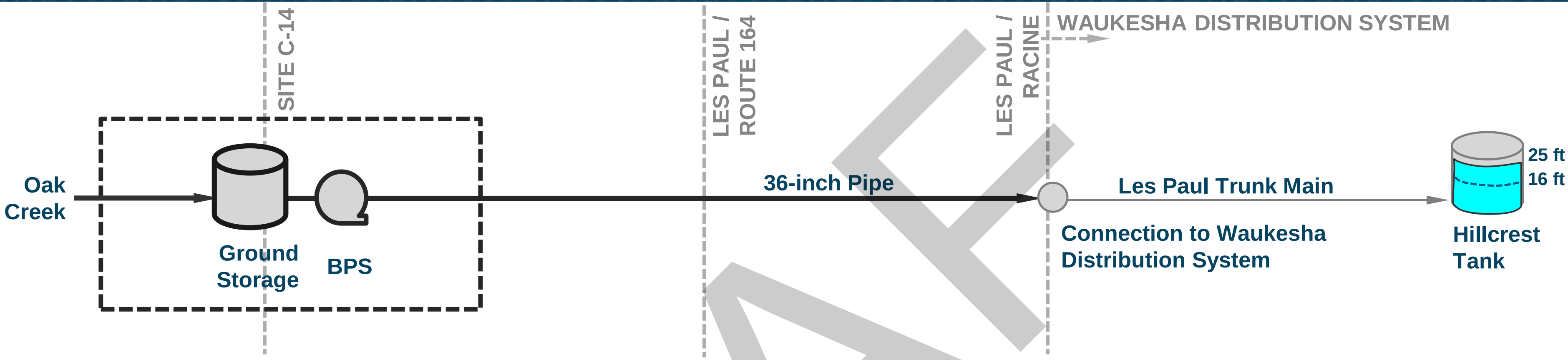
- Recommended Site
- Evaluated Site

N

BPS Operational Alternatives: Route Alternative 4



BPS Operational Alternatives: Route Alternative 4

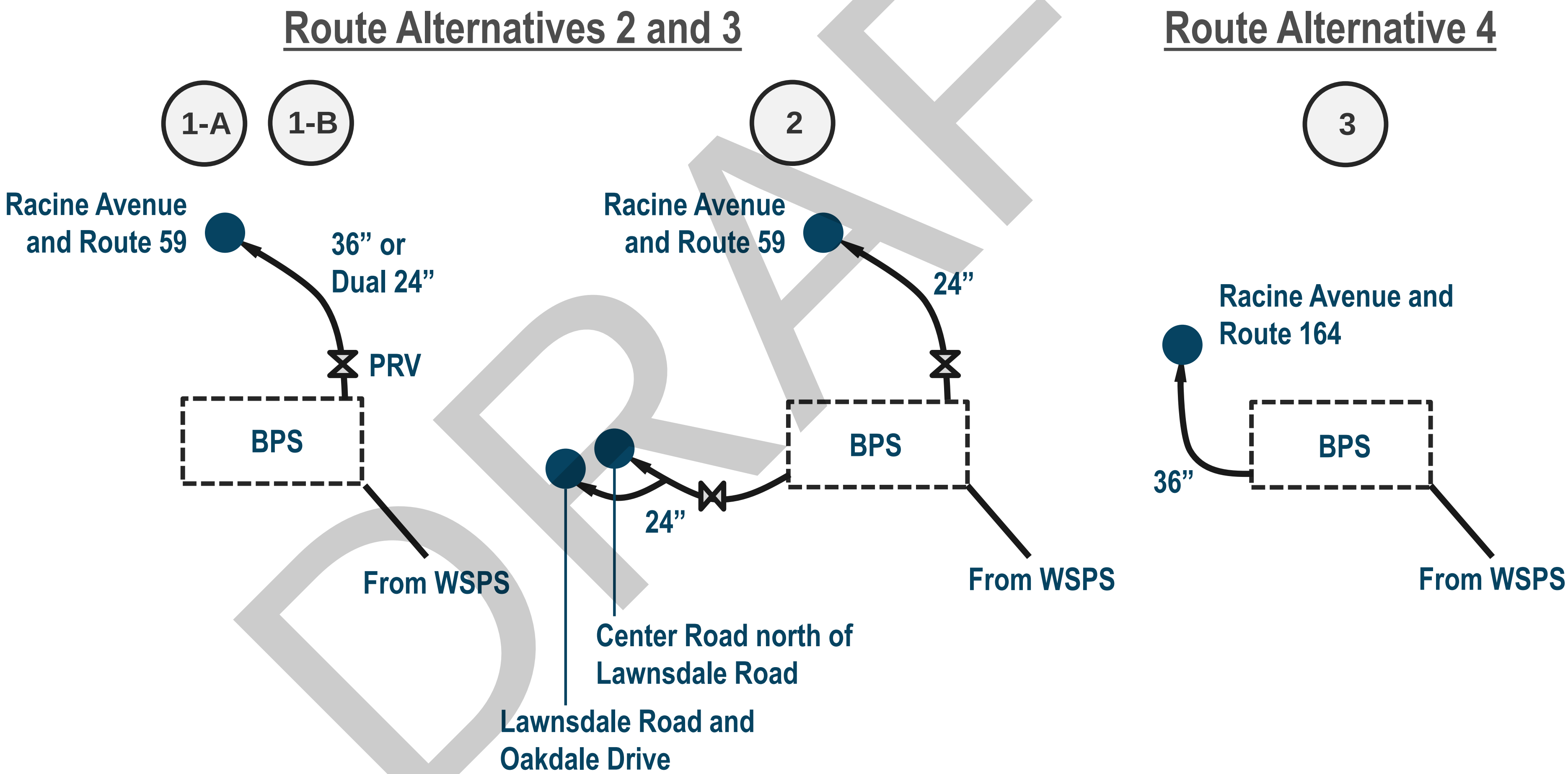


PROS	CONS
• Lower capital cost	• Higher energy required
• Operational simplicity	
• Operational flexibility	
• Typical application	
• Lower risk of pressures below 20 psi	
• Potential for energy recovery	

BPS Discharge Pipeline Evaluation

BPS Discharge Pipeline Evaluation: Alternatives

- Discharge Pipeline Alternatives:



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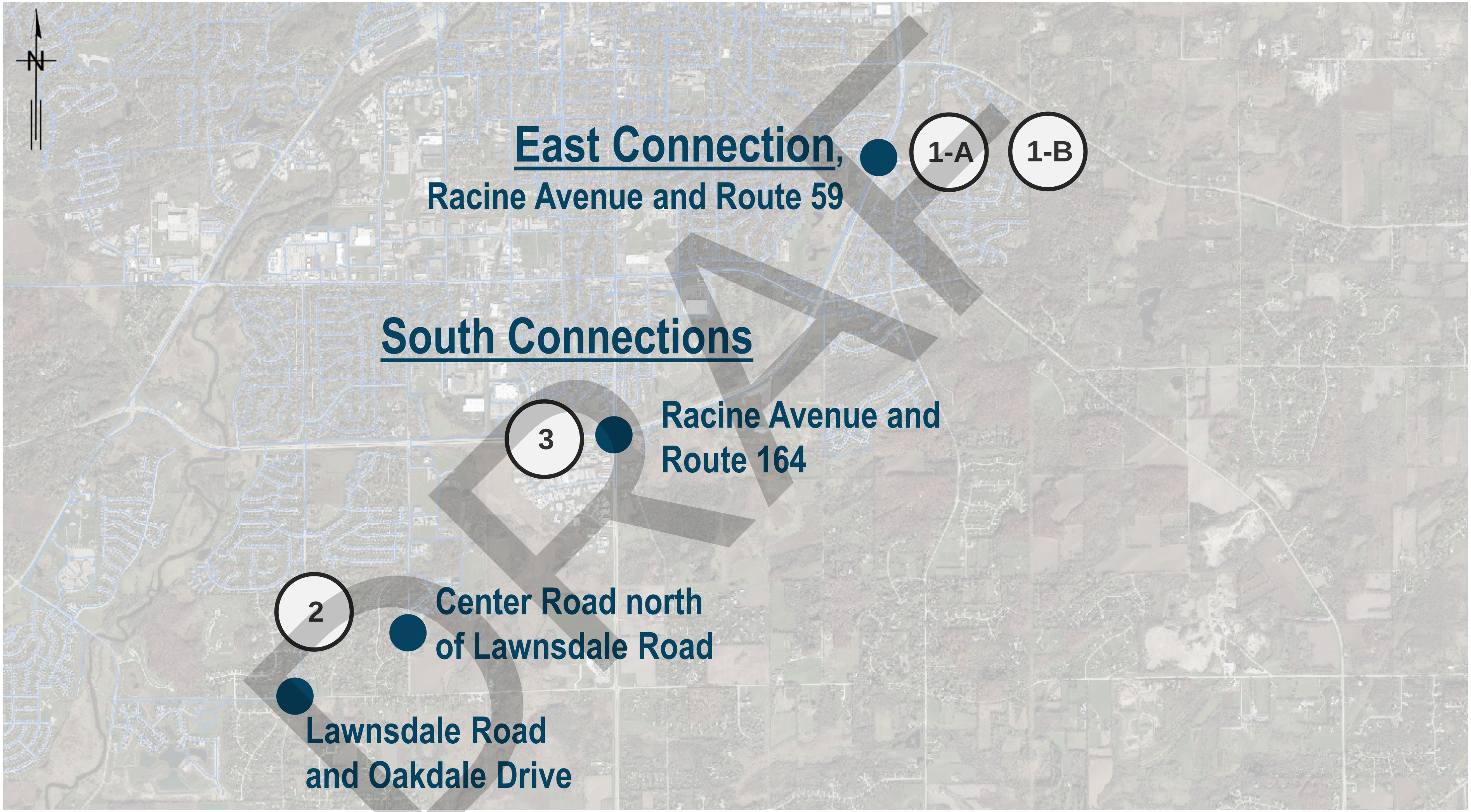
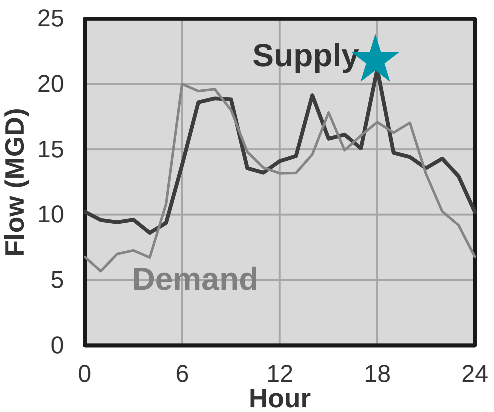
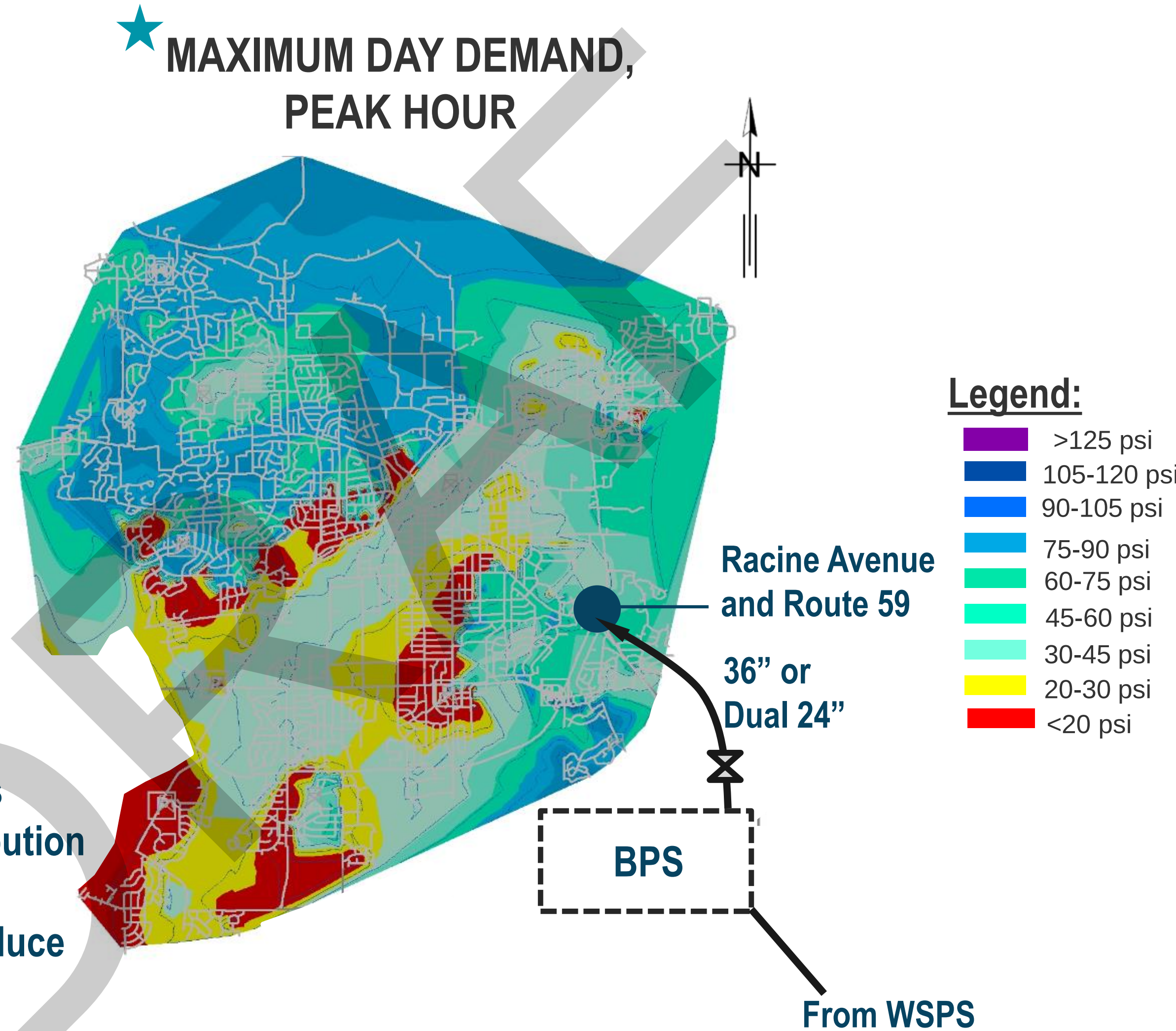
BPS Discharge Pipeline Evaluation: Alternatives



BPS Discharge Pipeline Evaluation: Alternative 1-A/1-B – East Connection, Single or Dual Pipelines





Key Finding:

- Single eastern connection is anticipated to require distribution system improvements
- Dual pipelines would not reduce need for distribution system improvements

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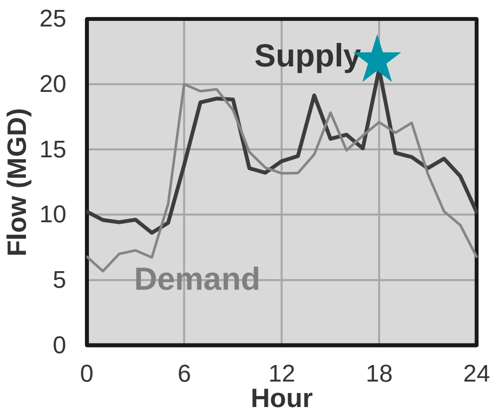
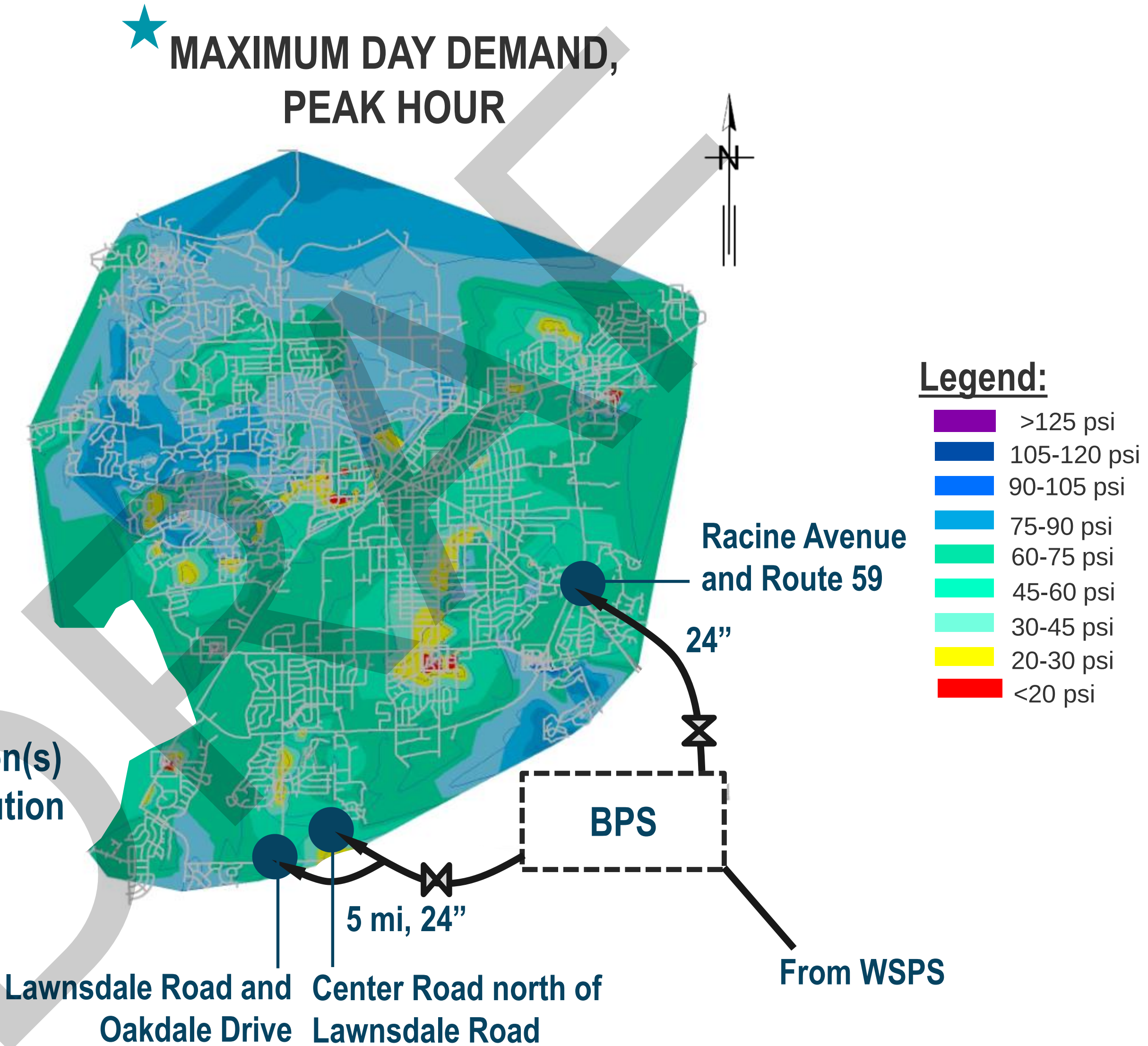
BPS Discharge Pipeline Evaluation: Alternative 2 – Dual Pipelines at East and South Connection

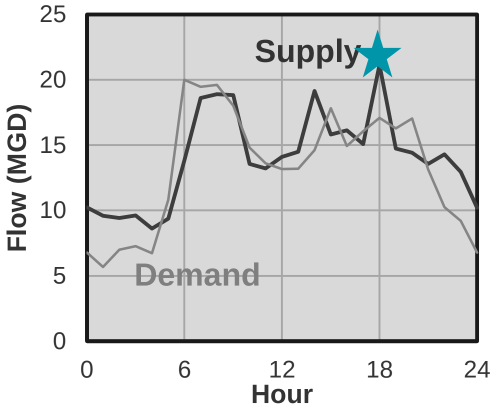


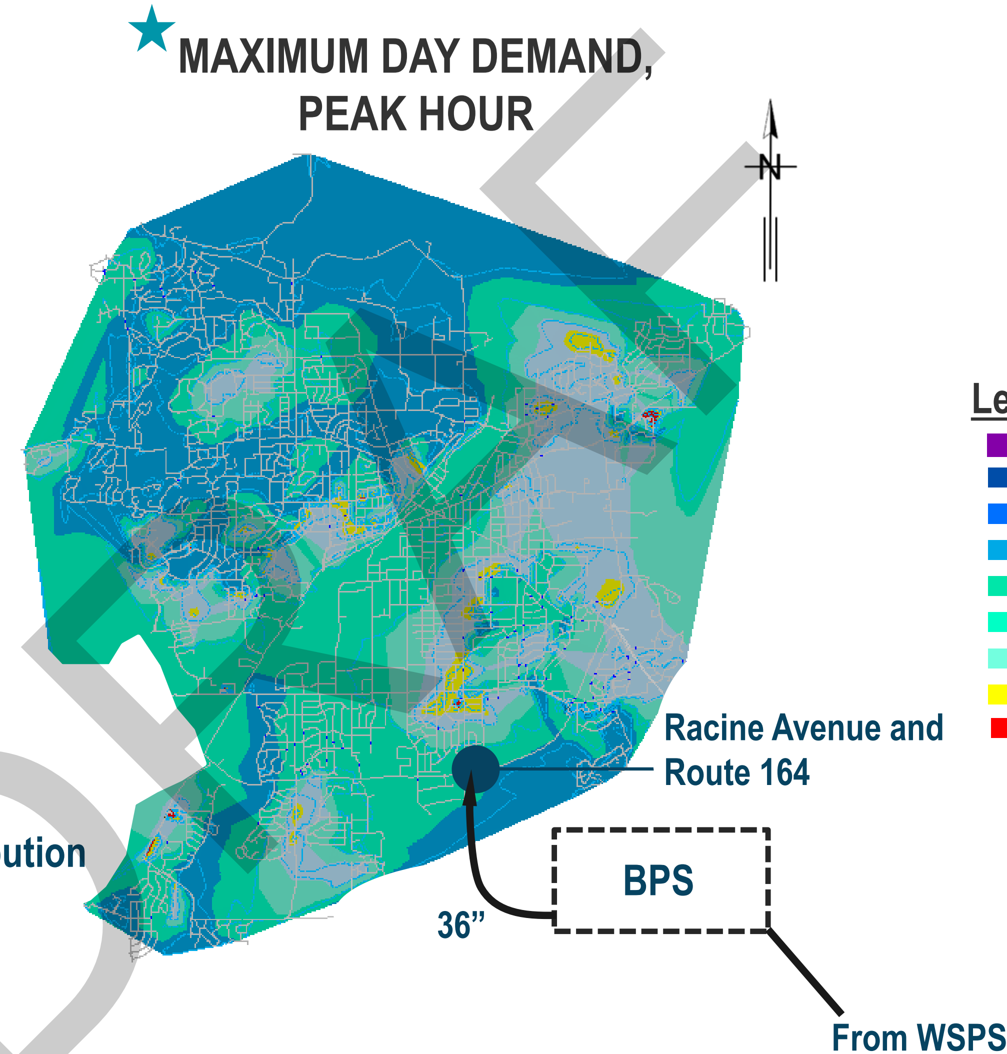


Key Finding:

- Second southern connection(s) reduce potential for distribution system improvements

BPS Discharge Pipeline Evaluation: Alternative 3 – Single Pipeline at South Connection





Legend:
- >125 psi
- 105-120 psi
- 90-105 psi
- 75-90 psi
- 60-75 psi
- 45-60 psi
- 30-45 psi
- 20-30 psi
- <20 psi

Key Finding:
- Single southern connection reduces potential for distribution system improvements

Waukesha Water Utility
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BPS Operational Alternatives: Comparison

BPS Discharge Pipeline Evaluation				
	BPS Discharge Pipeline Alternatives ($M)			
	Routes 2 and 3			Route 4
Evaluation Item	1-A	1-B	2	3
Differential Connection Cost	+0	+9	+31	-10
Anticipated Dist. System Improvements	More	More	Less	Less
Redundancy	Less	Neutral	More	Less

Notes:

1. Utility Costs include $11.9M budgeted for distribution system improvements that is not reflected into this evaluation.
2. Differential Connection Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
3. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Waukesha Water Utility GREELEY AND HANSEN

BPS Operational Alternatives: Comparison

BPS Discharge Pipeline Evaluation				
	BPS Discharge Pipeline Alternatives ($M)			
	Routes 2 and 3			Route 4
Evaluation Item	1-A	1-B	2	3
Differential Connection Cost	+0	+9	+31	-10
Anticipated Dist. System Improvements	More	More	Less	Less
Redundancy	Less	Neutral	More	Less

Notes:

1. Utility Costs include $11.9M budgeted for distribution system improvements that is not reflected into this evaluation.
2. Differential Connection Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
3. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Alternative 1-B is less preferable due to higher capital costs at neutral redundancy

BPS Operational Alternatives: Comparison

BPS Discharge Pipeline Evaluation				
	BPS Discharge Pipeline Alternatives ($M)			
	Routes 2 and 3			Route 4
Evaluation Item	1-A	1-B	2	3
Differential Connection Cost	+0	+9	+31	-10
Anticipated Dist. System Improvements	More	More	Less	Less
Redundancy	Less	Neutral	More	Less

Notes:

1. Utility Costs include $11.9M budgeted for distribution system improvements that is not reflected into this evaluation.
2. Differential Connection Costs are presented in June 2017 dollars include capital cost with 3% bonds and insurance, 5% mobilization / demobilization, 25% contingency, and 15% contractor overhead and profit.
3. Cells shaded **green** are more preferable, cells shaded **red** are less preferable, and cells shaded **grey** are comparable to other alternatives.

Additional evaluation required to determine how alternatives compare against distribution system improvements based on economic and non-economic evaluation via calibrated model

Summary Wrap-Up and Action Items

Summary Wrap-Up and Action Items

- Confirmed Preferred Booster Pumping Station (BPS) Operational Configuration for Route Alternatives 2, 3, and 4, including:
  – Alternatives identified; and,
  – Preferred configuration.
- Discussed Potential BPS Discharge Pipeline Configurations, including:
  – Alternatives identified; and,
  – Next steps for evaluation.
- Supported Development of Distribution System Modeling Scenarios.

THANK YOU

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

GREELEY AND HANSEN

SUMMARY

The Great Lakes Water Supply Program Booster Pumping Station (BPS) Site and Building Meeting was held in the WWU Large Conference Room at 9:00 AM on June 29, 2017 to present Booster Pumping Station (BPS) conceptual site layouts, obtain input on BPS building and site considerations, gain consensus on the site to discuss with Waukesha County Park District, and gain consensus on functional components.

The attendees are listed on the attached sign-in sheet. The agenda, presentation material and meeting summary are attached. The actions items are summarized in the table below.

	Action Item	Action By	Due Date
1.	Provide site exhibits and stock photos of reservoirs.	L. Melcher	**7/7/17**
2.	Identify sanitary service options.	L. Melcher	**7/20/17**
3.	Develop conceptual building layout.	J. Schmidt	**7/25/17**
4.	Schedule meeting with the Park District representative regarding Minooka Park availability.	C. Richardson	**7/30/17**

Welcome

a) Meeting attendees introduced themselves and their role in the Program.
b) The objectives of the meeting and the work plan moving forward were discussed.

1) Booster Pumping Station (BPS) Alternatives Evaluation

a) The alternatives evaluation workplan was discussed along with the work completed as part of this meeting.

2) BPS Site Layouts

a) Conceptual reservoir sizing table was discussed as follows:
   i) It was identified that the Central Zone does not contain extra effective volume for utilization.
   ii) The team will continue to evaluate opportunities within the distribution system to optimize the use of existing storage.
   iii) Concerns were raised regarding water age with larger storage volumes at the BPS.
   iv) The team will consider options for optimizing storage at the BPS and phased approaches for reservoirs for conceptual design.
   v) The team will continue to evaluate alternatives based on 2 days of emergency volume at the BPS for conceptual design.
b) The criteria for how the conceptual site layouts were prepared was discussed as follows:
   i) Existing topography was taken in to account. Tanks were located on the high side of the sites with the building on the lower side of the sites.
   ii) Reservoir volume was provided with two circular tanks.
   iii) Reservoirs are located toward the back of the site.
   iv) The building was oriented to screen utility components to the extent possible.
   v) Environmental corridor and wetland impacts were minimized.

c) Conceptual site layouts for Routes 2 and 3 were discussed as follows:
   i) Site B-10.1A
      (1) The layout for B-10.1 A was presented and the advantages and disadvantages of the site were discussed. The site has several constraints, including encroachments into the anticipated wetland and environmental corridor setbacks. At this conceptual level, it was agreed that this appears to be the most challenging location.
   ii) Site B-10.1B
      (1) The layout for B-10.1 B was presented and the advantages and disadvantages of the site were discussed. This location is on the same parcel as B-10.1 A, but is southeast of the interior wetland. This location has several advantages to B-10.1 A, such as flexibility in building orientation and tank location with no known wetland or environmental corridor encroachments.
      (2) This site was preferred to B-10.1 A.
      (3) The availability of subject parcel and more specifically Site B-10.1 B will be discussed with the Waukesha County Department of Parks and Land Use.
d) Conceptual site layout for Route 4 was discussed as follows:
   i) Site C-14
      (1) The layout for C-14 was presented and the advantages and disadvantages of the site were discussed. This location has several advantages such as flexibility in building orientation and tank location with no known wetland or environmental corridor encroachments.
e) WWU provided the following input on the site layouts:
   i) Access for fire protection should be accounted for.
   ii) Separate parking locations on the sites are not required.
   iii) Verify that the base of the pump is 2 ft above the 100 yr flood plain elevation per the Wisconsin administrative code.
   iv) WWU's preference is that generators are located exterior to the building and properly screened. Placement in the rear of the building is preferred.
   v) The Program team will need to determine what entities will govern or influence site and building components for each site.
   vi) A fence will be required around the reservoirs. The team will evaluate fencing around access points and vents.

3) **BPS Building Functional Components**
   a) Applicable codes and standards were discussed along with previous input from WWU that is shaping the functional components of the BPS building.
   b) WWU provided the following input on the BPS functional components:
      i) Pump Room
         (1) There is no preference for bridge crane or monorail crane. WWU would like GH to provide recommendation based on building layout.
         (2) WWU would like GH to consider pump noise when locating lab space. If needed, hearing protection will be provided.
         (3) Flow metering equipment will be located in the building.
      ii) Chemical Rooms

(1) WWU asked if an external eyewash station could be avoided if WWU staff is present during deliveries and doors are open to internal eyewash stations.
(2) Provide a location or shelf for safety gear and equipment.

iii) Electrical Room
(1) WWU prefers nice straight isles and ample space between components.
(2) Remote Terminal Unit will be located in this room. No need for separate control room.
(3) WWU prefers the use of taller doors on the exterior of the building for this room.

iv) Transformer Area
(1) WWU would like to confirm transformer size as soon as possible.

v) Generator Area
(1) WWU prefers that the generators be located exterior to the building.
(2) Will require proper silencing and noise dissipation.

vi) Battery Room
(1) This room will be covered in more detail in the Electrical Meeting.

vii) Mechanical Room
(1) It was noted that the size of this space is very fluid and dependent on a number of variables.
(2) WWU prefers the mechanical equipment to be located inside the building.
(3) WWU is open to options on the location of HVAC equipment.
(4) WWU prefers unit heaters with a simple wall mounted thermostat for heating spaces.
(5) WWU noted that AC is acceptable for the Electrical Room to keep equipment cool.

viii) Fire Protection Area
(1) It was noted that this space could be incorporated into others spaces.
(2) Components of this space would need to be accessible to local Fire Department.
(3) WWU asked that the Fire Department access to spaces within the building be evaluated relative to the requirements of the applicable codes.

ix) Parts Storage Area
(1) Items to be located in this space consist of tools, gaskets, gauges, small pipe, hoses, rebuild kits, etc.
(2) This could be comprised of a quantity of shelving to be determined, along a wall within a suitable space (ie. Mechanical Room).
(3) WWU requested that space be provided near the designated lab area for the storing of plans, specifications, O&M manuals, etc.

x) Personnel Area
(1) WWU requests one (unisex) bathroom with a lavatory and sink.
(2) Others items listed in this space are not required.
(3) WWU requested that hallways and corridors be minimized and access to rooms from the main Pump Room would be acceptable.

xi) Receiving Area
(1) WWU prefers individual loading locations based on requirements of each space versus a consolidated receiving area.
(2) WWU asked for recommendations from GH based on building layout and crane options.

xii) General Building

(1) Flat roofs are not preferred.
(2) WWU prefers masonry units with a painted finish for interior walls.
(3) GH will need to confirm availability of sanitary service to the building.
(4) No vehicle parking will be provided inside the building.
(5) WWU requested that GH take security of the building into consideration when planning the use of natural lighting.
(6) WWU would prefer an alternate to the use of gutters and downspouts as applicable.

4) Summary Wrap-Up and Action Items

a) The goals and objectives were reviewed and completed.
b) The team will begin discussion with the Waukesha County Department of Parks and Land Use on availability of location within the parcel associated with Site B-10.1.
c) A meeting will be held in July to discuss the BPS operation.
d) A meeting will be held in July to discuss conceptual BPS building layout and features.
e) The action items are summarized in the table on page 1 of this summary.

This meeting summary reflects the discussions and decisions reached at the meeting. If no objections are put forth within 5 business days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting.

GREAT WATER ALLIANCE

BPS SITE AND BUILDING MEETING
SIGN-IN SHEET

June 29, 2017

No.	Name	Company	Initial
1	Dan Duchniak	WWU	[redacted]
2	Kelly Zylstra	WWU	
3	Cathy Busking	Greeley and Hansen	
4	John Schmidt	Greeley and Hansen	
5	Katie Richardson	Greeley and Hansen	
6	Lee Melcher	Greeley and Hansen	
7	Nicole Spieles	Greeley and Hansen	
8			
9			
10			
11			
12			
13			
14			
15			

AGENDA

Date/Time: June 29, 2017 9:00 a.m. – 11:00 a.m.

Location: WWU Large Conference Room, 115 Delafield St., Waukesha, WI 53187

Attendees:

Dan Duchniak, WWU
Kelly Zylstra, WWU
Cathy Busking, GH
John Schmidt, GH
Katie Richardson, GH
Lee Melcher, GH
Nicole Spieles, GH

Time	Topic	Presenter(s)
9:00 a.m.	Welcome Goals and Objectives	Nicole Spieles
9:05 a.m.	Booster Pumping Station (BPS) Alternatives Evaluation	Lee Melcher
9:15 a.m.	BPS Site Layouts	Cathy Busking
10:00 a.m.	BPS Building Functional Components	John Schmidt
10:45 a.m.	Summary Wrap-up and Action Items	Nicole Spieles
11:00 a.m.	Adjourn	

Great Lakes Water Supply Program

Great Water Alliance | Task 6-200 Meeting No. 1

BPS Site and Building Meeting

June 29, 2017

GREAT WATER ALLIANCE

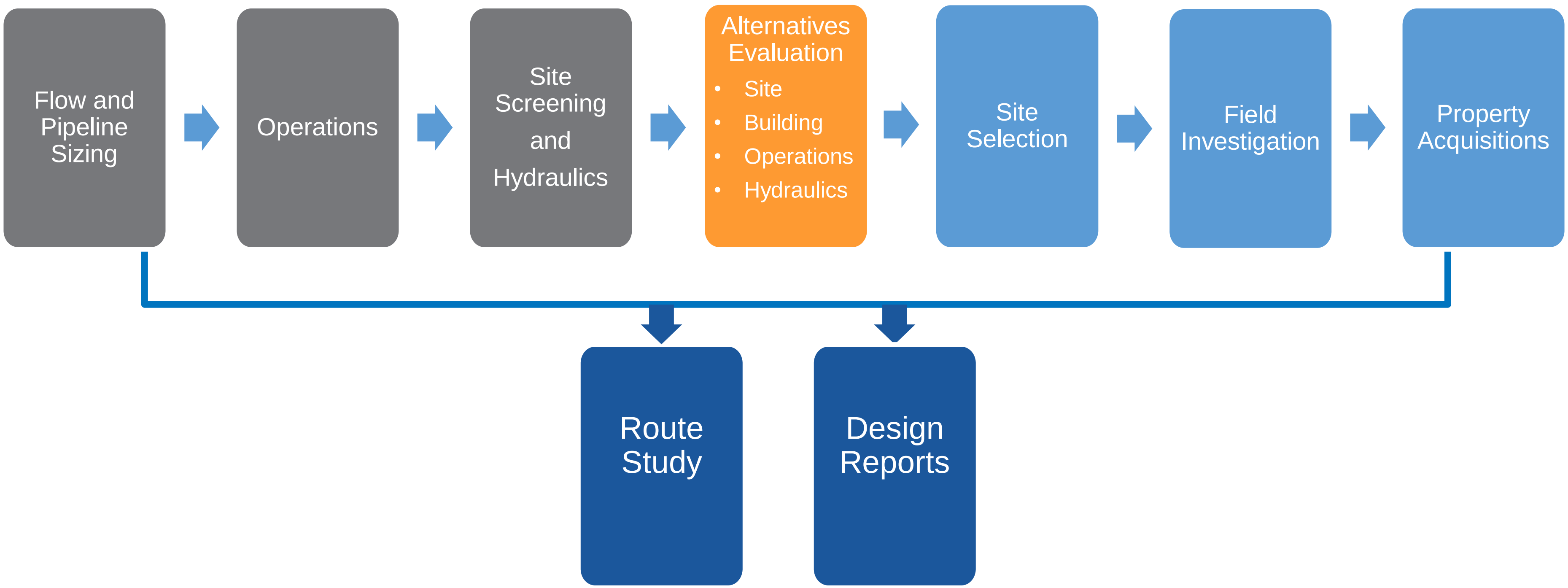
GREELEY AND HANSEN

Meeting Goals and Objectives

- Understanding of Booster Pumping Station (BPS) alternatives evaluation
- Present BPS site layouts
  - Reservoir sizing
  - Conceptual hydraulic profile
  - Site plans for preferred sites
  - Site considerations
- Obtain input on BPS building and site considerations
- Consensus on site to discuss with Waukesha County Park District
- Present BPS functional components
- Consensus on functional components

Booster Pumping Station Alternatives Evaluation

Facilities Workplan



Booster Pumping Station Alternatives Evaluation

- Site Layout
  - Reservoir sizing
  - Conceptual hydraulic profile
  - Conceptual site layouts
  - Site considerations
    - Grading
    - Ownership (public vs. private)
    - Accessibility (vehicles)
    - Further expansion / modifications
- Functional Components
  - Architectural considerations
    - Code review
  - Space planning considerations
    - Adjacency, space contents, WWU feedback, other considerations

Booster Pumping Station Site Layouts

Reservoir Sizing

Storage Category	Storage Type	Distribution System (Central Zone)	Supply System 2-ADD Storage	Supply System 1-ADD Storage
Operational Storage	Dist. Sys Pump Operation (15%) [2]	283,000	**--**	--
	Supply Sys Pump Operation (15%)	--	**2,800,000**	1,600,000
	Dis.t Sys PH Attenuation[2]	947,000	**--**	--
	Supply Sys Pump Attenuation	--	**2,400,000**	2,400,000
Emergency Storage	Central Zone Fire Protection[2]	630,000	**--**	--
	Supply Maintenance	--	**13,200,000**	6,600,000
Total Required [2]		1,860,000	**18,400,000**	10,600,000
Existing Available [2]		1,926,000	**--**	--
Additional Required		0	**18,400,000**	10,600,000

Operational Storage (Pump Operation)

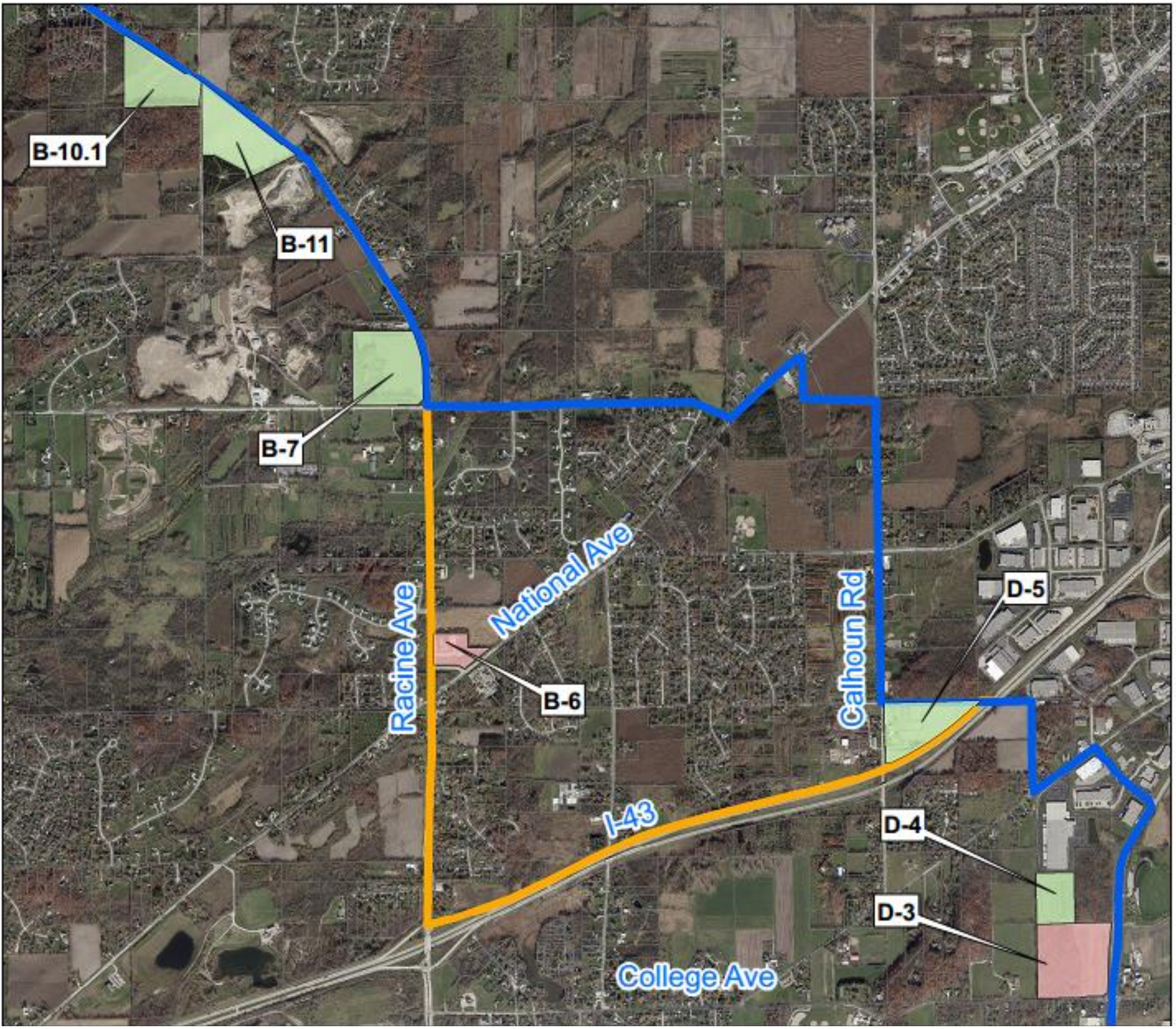
Operational Storage (Attenuation)

Emergency Storage (Fire / Maintenance)

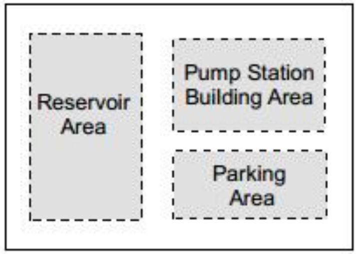
1) ADD = Average Day Demand equal to 6.6 MGD based on historical data
2) Existing distribution system central zone volumes from Technical Memorandum No. 3 – Water Model Update and Capital Improvement Planning Deficiency Analysis, System Evaluation, and Recommendations, Table 7, AECOM, 2012

Route 2 & 3 Preferred Site Evaluation

HANDOUT NO. 5



Key Map



Conceptual Site Layout
Estimated Acreage 8.0 Acres

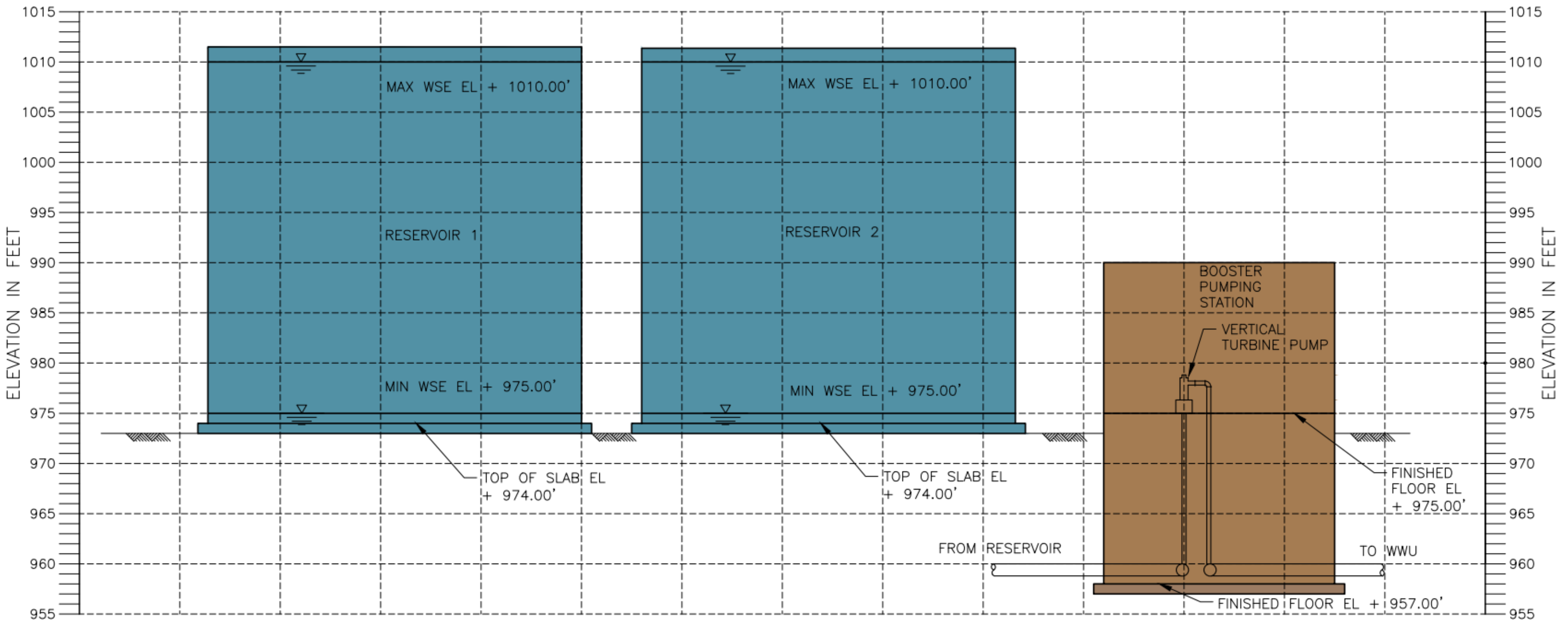
Site Number	Acreage
B-10.1	27
B-11	29
B-7	57
B-6	9
D-5	25
D-4	13
D-3	36

Legend

- Recommended Site
- Evaluated Site

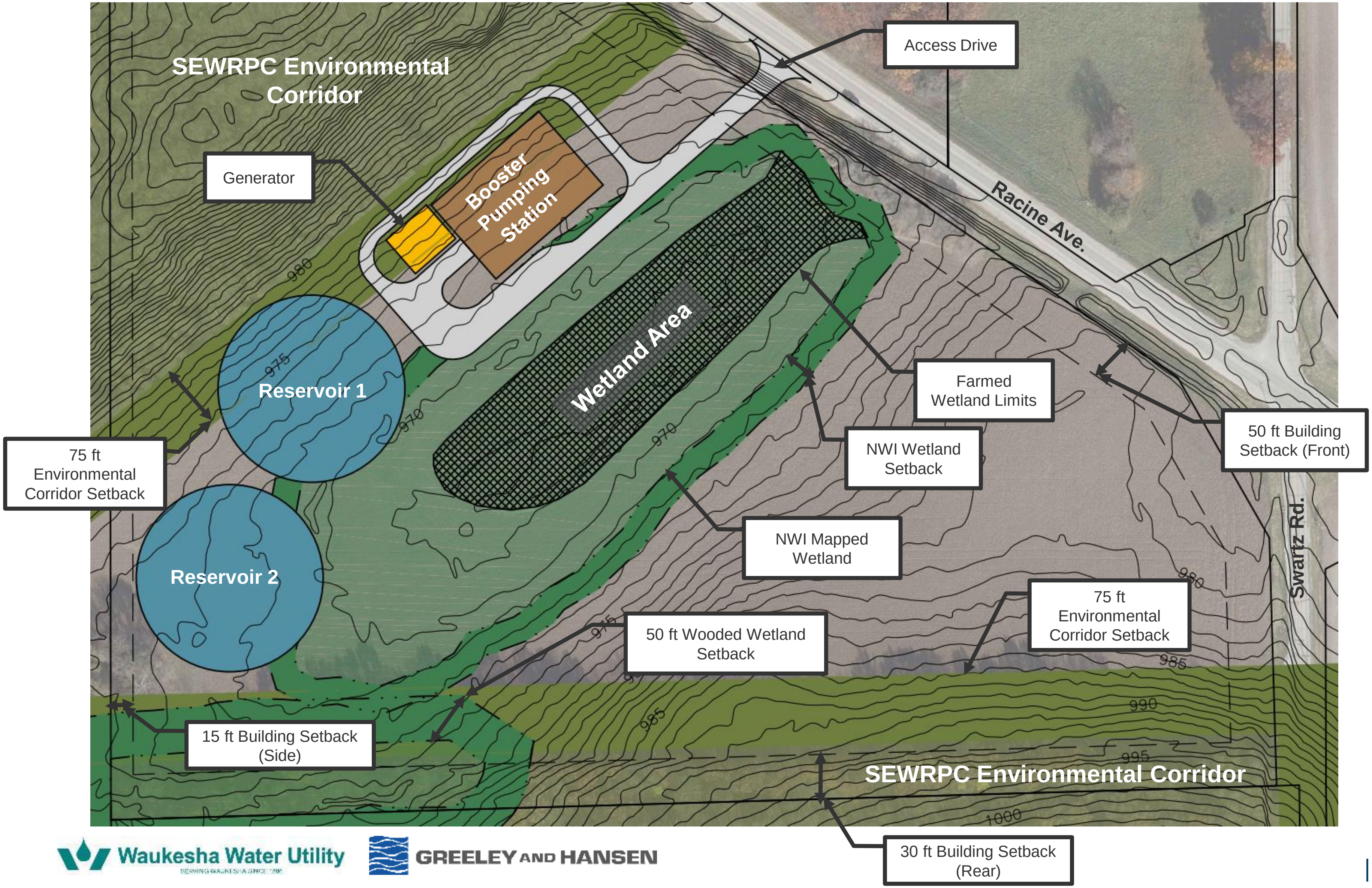
Waukesha Water Utility
GREELEY AND HANSEN

Route 2 & 3 Preferred Site B-10.1A Hydraulic Profile



Waukesha Water Utility GREELEY AND HANSEN

Site B-10.1A Conceptual Site Plan



Waukesha Water Utility

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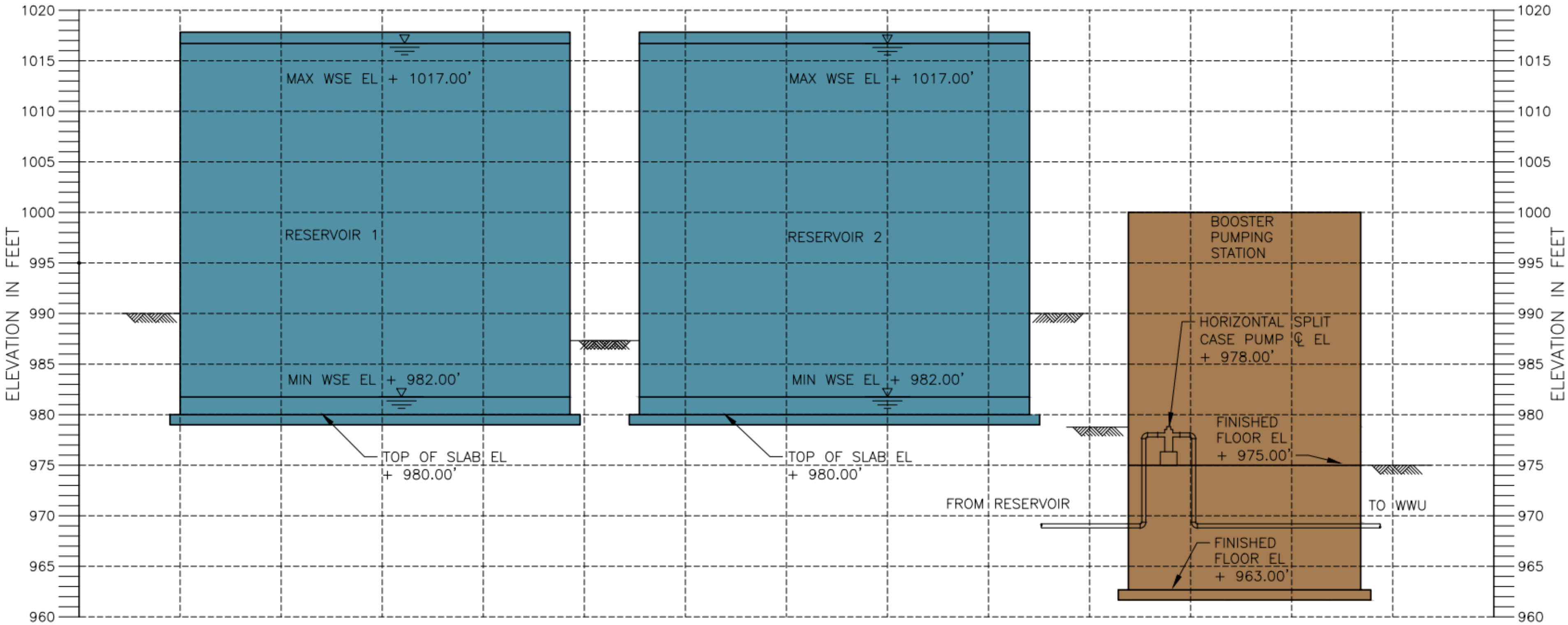
Site B-10.1A Considerations and Constraints

PROS	CONS

• Publicly owned land
    • Granted by Minooka Park
• Tanks located away from the roads
	• Encroachments
	    • Environmental Corridor
	    • Wetland
	• Space constraints
	    • May require additional tanks
	    • Construction and staging
	    • Future expansion
	    • Potential retaining walls
	    • Limitations on building layouts

Route 2 & 3 Preferred Site B-10.1B Hydraulic Profile



Waukesha Water Utility

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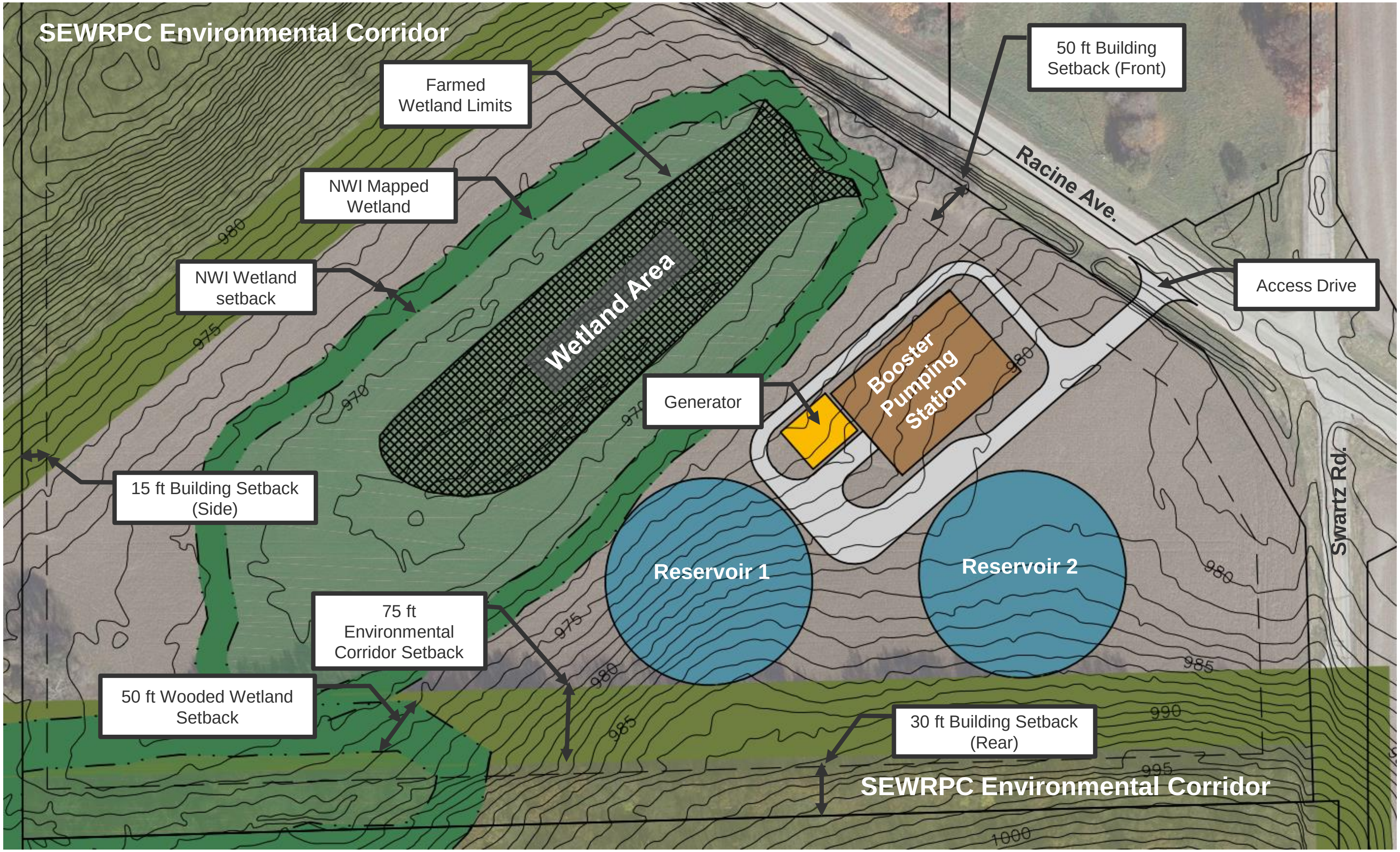
Site B-10.1B Conceptual Site Plan



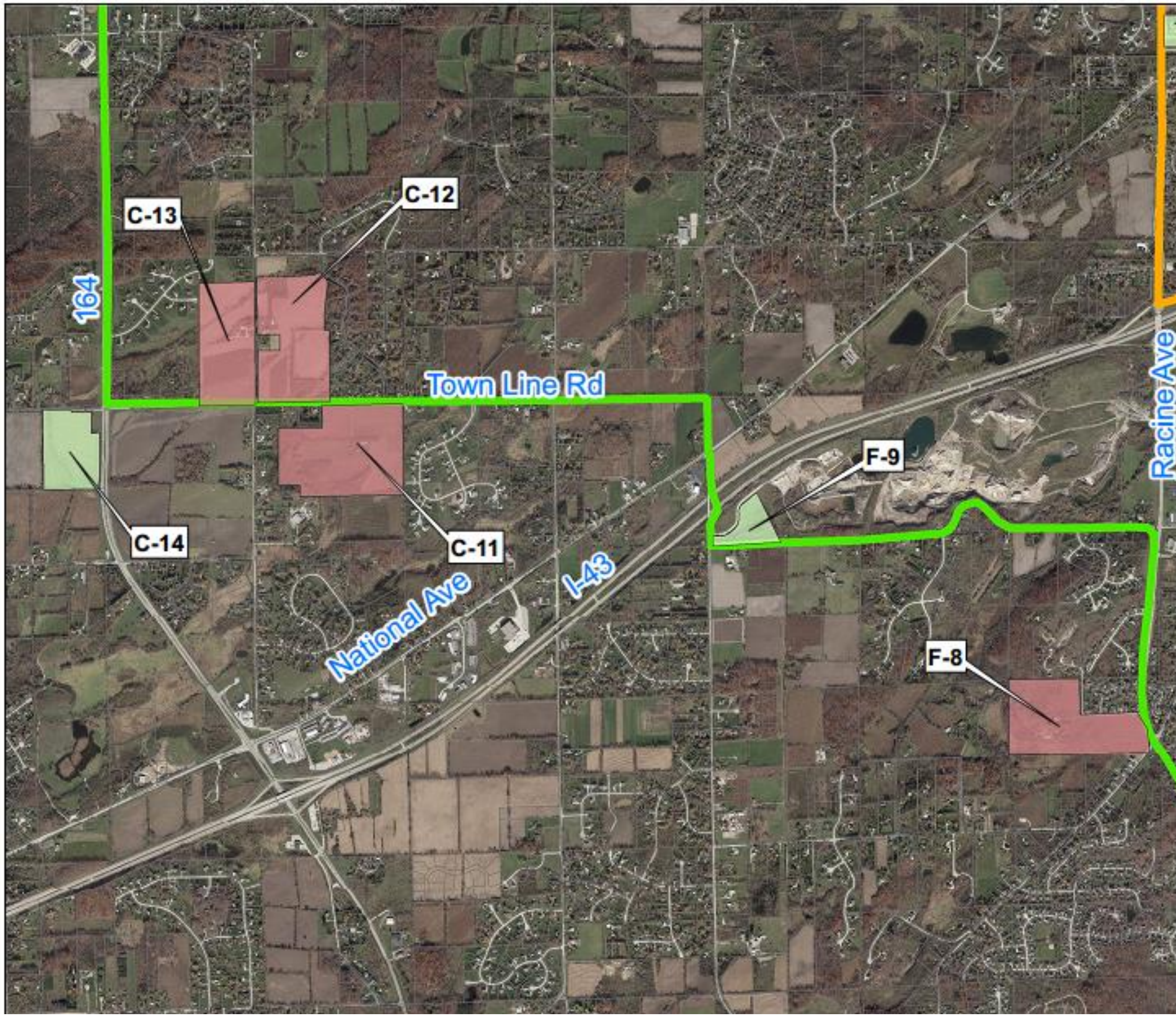
Waukesha Water Utility GREELEY AND HANSEN

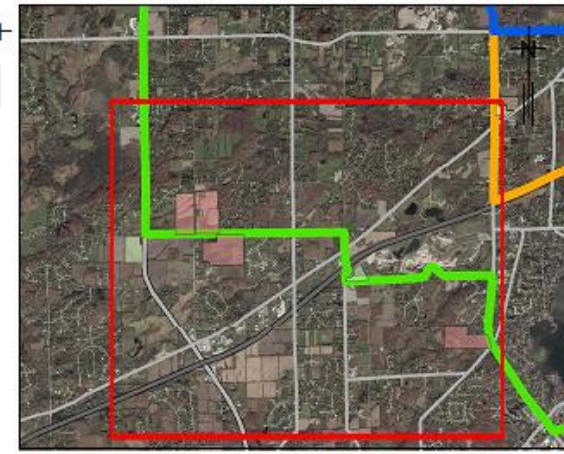
Site B-10.1B Considerations and Constraints

PROS	CONS
• Publicly owned land • Flexibility for site components • Flexibility for building layouts • Flexibility for site access • Tanks located away from roads • Site hydraulics • Encroachments - avoidable	• Not granted by Minooka Park

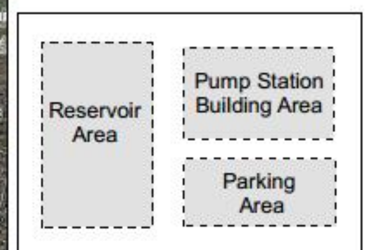
Route 4 Preferred Site Evaluation

HANDOUT NO. 6





Key Map



Conceptual Site Layout
Estimated Acreage 8.0 Acres

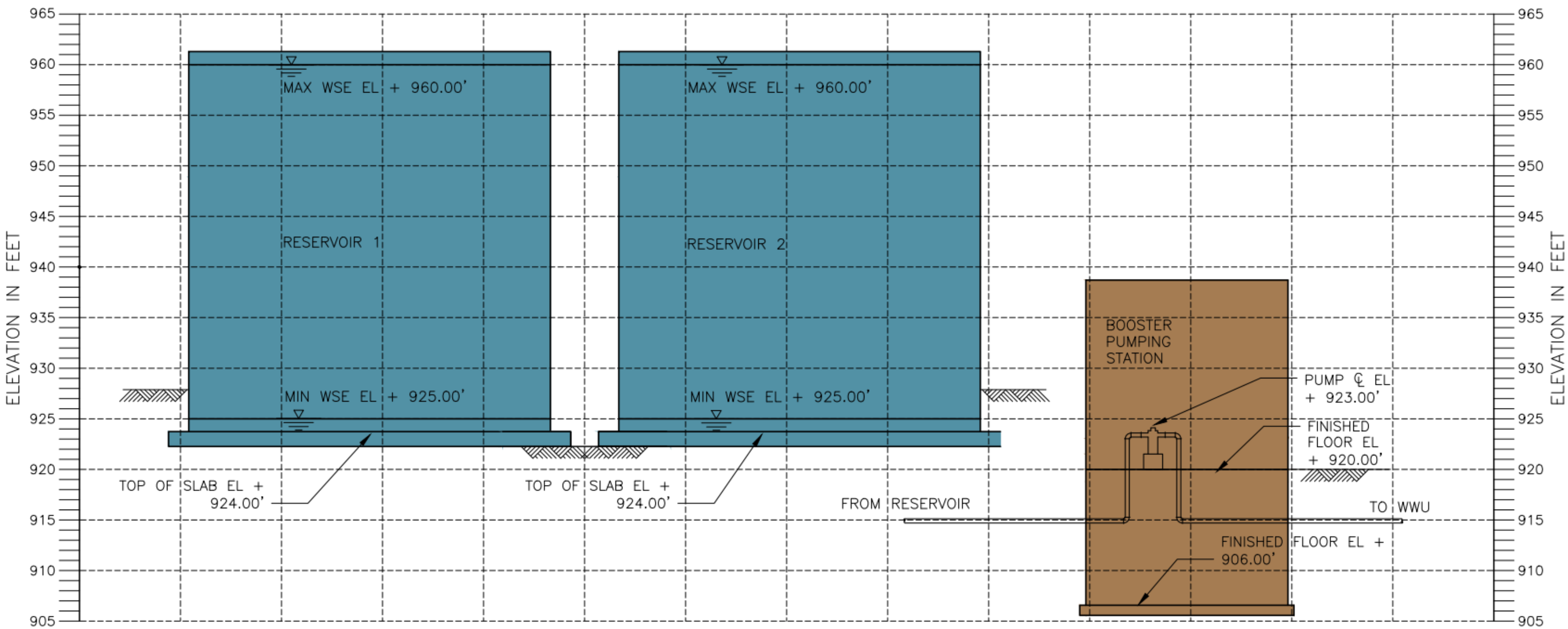
Site Number	Acreage
F-8	58
F-9	12
C-11	75
C-12	60
C-13	50
C-14	30

Legend

- Recommended Site
- Evaluated Site

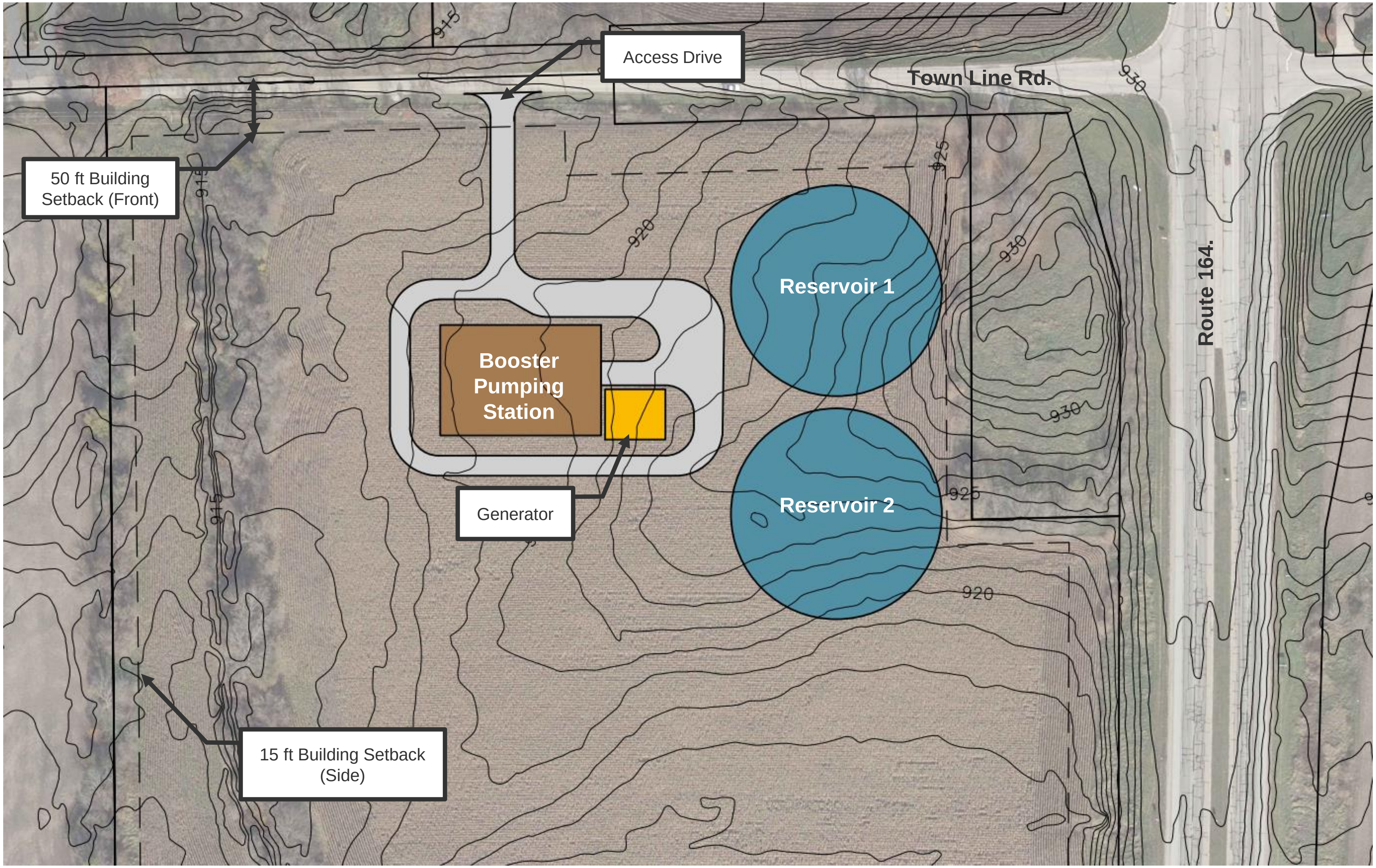
Waukesha Water Utility GREELEY AND HANSEN

Route 4 Preferred Site C-14 Hydraulic Profile



Waukesha Water Utility GREELEY AND HANSEN

Site C-14 Conceptual Site Plan



Waukesha Water Utility
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Site C-14 Considerations and Constraints

PROS	CONS
• Flexibility for site components • Flexibility for building layouts • Flexibility for site access • Flexibility for future improvements • Site hydraulics • Encroachments – none identified	• Privately owned land • Tanks close to Route 164

Booster Pumping Station Functional Components

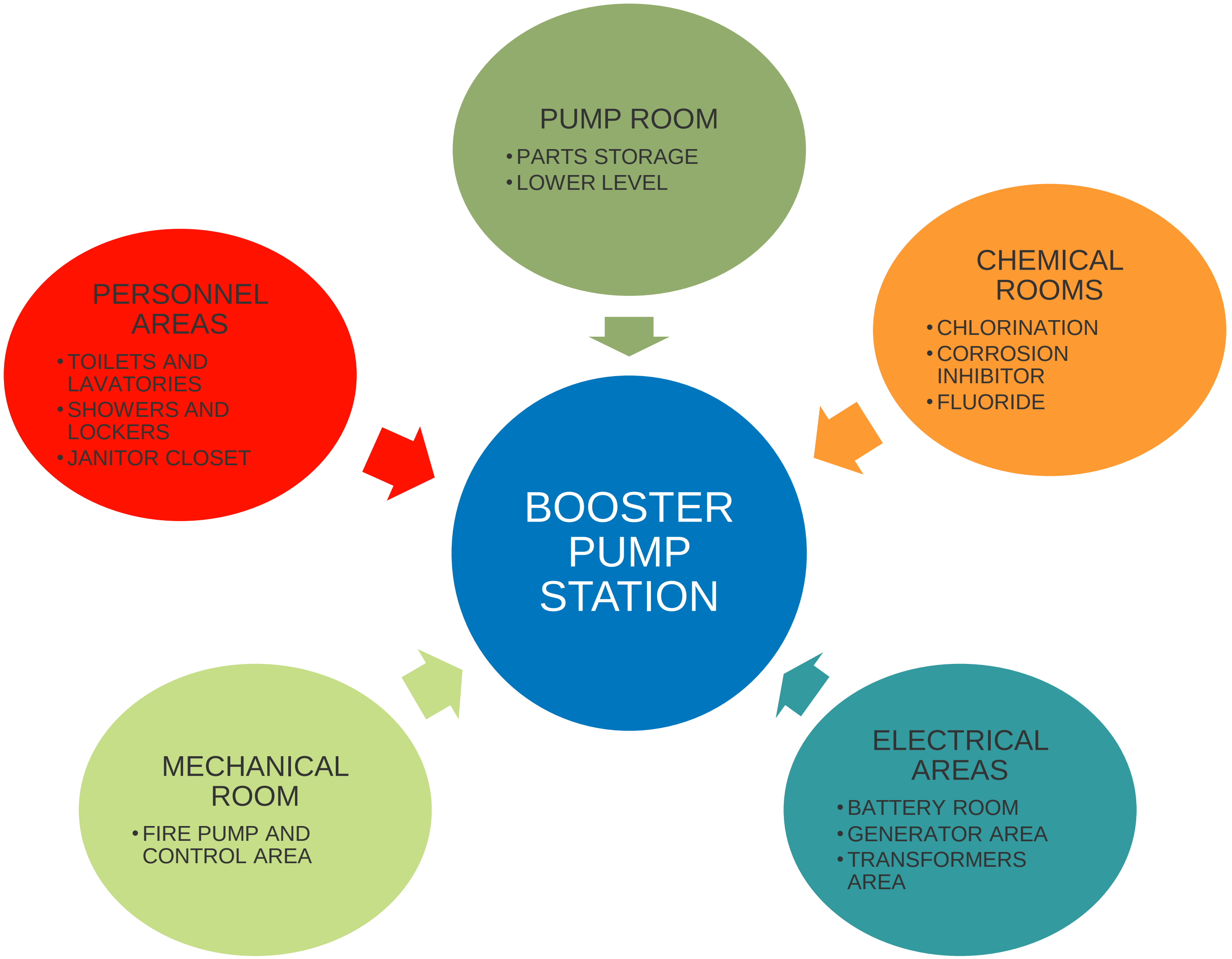
Architectural Considerations

- Applicable Codes, Ordinances, and Standards:
  - Wisconsin Commercial Building Code (IBC 2009 + Amendments)
  - Commercial Building Energy Code: (ASHRAE 90.1-2007)
  - Zoning Ordinances: Varies by Location
  - OSHA: Section 1910 General Industry
  - NFPA Documents
    - NFPA 1: Fire Protection and Safety Code
    - NFPA 30: Flammable and Combustible Liquids
    - NFPA 400: Hazardous Materials Code
    - NFPA 430: Storage of Liquid and Solid Oxidizers

Operations Tour Feedback

- Permanent bridge crane in pump room
- Loading dock w/ access to bridge crane in pump room
- Space for additional emergency generators
  - Cable storage, access and deployment
- Transfer station for chemical storage facilities
- Storage area for parts
- Access/ use of natural light within working areas of facilities
- Laboratory station

Space Planning Considerations



Pump Room Upper Level (F-2 Low Hazard)

- Approximate Size
  - Area: 4,000 sqft
  - Height: 20-24 ft
- Access and Adjacency
  - Centrally located
  - Direct access to exterior
- Contents
  - Booster pumps
  - Hoisting mechanism
    - Bridge crane or monorail
  - Floor hatch to lower level
  - Laboratory area
    - Sink, counter and cabinet
  - Dehumidifiers

Pump Room Lower Level (F-2 Low Hazard)

- Approximate Size
  - Area: 6,000 sqft
- Access and Adjacency
  - Centrally located under pump room
  - Direct access to pump room via floor hatch
- Contents
  - Header piping
  - Valves
  - Flow meters
  - Chemical injection
  - Sump pumps
  - Dehumidifiers
  - Sprinklers

Chemical Rooms (High Hazard)

- Approximate Size
  - Area: 4,000 sqft
- Access and Adjacency
  - Direct access to exterior
  - Direct access to receiving area
- Contents
  - Transfer station
  - Storage racks/ tanks
  - Chemical feed pumps
  - Sprinklers
  - Eye wash/ shower

Electrical Room (F-1 Moderate Hazard)

- Approximate Size
  - Area: 1,600 sqft
- Access and Adjacency
  - Near generator area
  - Direct access to exterior
  - Direct access to pump room
- Contents
  - Low voltage equipment
    - Motor Control Center (MCC)
    - Low Voltage Switchgear
    - Variable Frequency Drives (VFDs)
    - Panels

Transformer Area (Exterior)

- Approximate Size
  - Area: 750 sqft
- Access and Adjacency
  - Near electrical room
- Contents
  - Transformer units
  - To be screened from view

Generator Area (Exterior)

- Approximate Size
  - Area: 2,000 sqft
- Access and Adjacency
  - Near electrical and battery rooms
  - Direct access to access drive
- Contents
  - Fuel tanks
  - Enclosed generators
  - Enclosed paralleling gear
  - To be screened from view
  - Silencing / dampening equipment

Battery Room (F-1 Moderate Hazard)

- Approximate Size
  - Area: 200 sqft
- Access and Adjacency
  - Near generator area
  - Near electrical room
  - Direct access to exterior
- Contents
  - Batteries
  - Eye wash/ shower

Mechanical Room (F-2 Low Hazard)

- Approximate Size
  - Area: TBD
- Access and Adjacency
  - Direct access to exterior
- Contents
  - Backflow prevention
  - Domestic water heaters
  - HVAC units (roof mounted?)
  - Plumbing and controls

Fire Protection Area (F-2 Low Hazard)

- Approximate Size
  - Area: 600 sqft or less
- Access and Adjacency
  - Near mechanical room, chemical facilities, battery room, and pump room lower level
  - Direct access to exterior
- Contents
  - Fire pumps (if needed)
  - Fire control panel

Parts Storage Area (F-2 Low Hazard)

- Approximate Size
  - Area: 800 sqft
- Access and Adjacency
  - Near Pump Room
- Contents
  - Storage Racks
  - Pipes and Connectors
  - Machinery
  - Hazardous Materials? (impacts HVAC)

Personnel Area (F-2 Low Hazard)

- Approximate Size
  - Area: TBD
- Access and Adjacency
  - Near Mechanical Room
- Contents
  - Lavatories, toilets, urinals and bathroom accessories
  - Janitor closet
    - Service sink and storage rack
  - Drinking fountain (bubbler)
  - Showers and lockers
  - Kitchenette, tables and chairs
  - Hallways and corridors
  - Display space for tours

Receiving Area (Exterior)

- Approximate Size
  - Area: TBD
- Access and Adjacency
  - Near chemical facilities
  - Near electrical and mechanical rooms
  - Direct connection to pump room
- Contents
  - Dock levelers
  - Hoisting equipment
  - Recessed at grade or elevated truck docks

Additional Thoughts

- Comments, Questions or Concerns Regarding:
  - The functional components covered today
  - Other components not covered
  - How these components will evolve within the design process

Summary Wrap-Up and Action Items

Summary

- Understanding of Booster Pumping Station (BPS) alternatives evaluation
- Presented BPS site layout
  - Reservoir sizing
  - Conceptual hydraulic profiles
  - Site plans for preferred sites
  - Site considerations
- Obtained input on BPS building and site considerations
- Consensus on site to discuss with Waukesha County Park District
- Presented BPS functional components
- Consensus on functional components

Next Steps

- Begin discussion with property owners / access to site
  - Site B-10.1
  - Exhibits for discussion with property owners
- BPS operations and hydraulics meeting
- Building development and meeting
- Conduct field investigations
- Property acquisitions

THANK YOU

Waukesha Water Utility
SERVING WAUKESHA SINCE 1886

GREELEY AND HANSEN

SUMMARY

The Great Lakes Water Supply Program Water Supply Facilities Tour – Electrical and Mechanical Meeting was held at five Waukesha Water Utility (WWU) facilities at 9:00 a.m. on July 13, 2017 to visit and discuss the electrical and mechanical components of the facilities located at Well 6, Well 8, Well 9, Well 10, and the Utility.

The attendees are listed on the attached sign-in sheet. The agenda and discussion topics are attached. The action items are summarized in the table below.

	Action Item	Action By	Due Date
1.	Develop a list of shop drawings and O&Ms that will be requested from WWU.	N. Hughes A Mande M. Morris	**8/14/17**
2.	Present and discuss evaluation of diesel vs. natural gas fired generator sets during Water Supply Facilities Electrical, Mechanical, and SCADA Meeting	M. Morris	**8/24/17**

Welcome

a) Attendees introduced themselves and their role in the Program.

Discussion Topics and Associated Notes

1) Process

a) Chemical feed pumps
   i) WWU's preference for chemical feed pump is peristaltic or diaphragm. The preferred manufacturers are Watson-Marlow or Jesco for Silicates and Watson-Marlow or ProMinent for chlorine. WWU has found that Jesco pumps for silicates and ProMinent pumps for chlorine are easier to maintain and replace parts.

b) Chemical feed system
   i) Chemical tanks are currently filled using transfer pumps and amount is monitored by scale rather than level sensor. Level sensors are installed at the tanks but not utilized.
   ii) Chemical containment area at Well 10 is below grade with grating over the top.
   iii) Chlorine analyzers are ProMinent.

c) Actuators
   i) The filter system at Well 8 has pneumatic actuators as facility has compressed air system for the treatment process.
   ii) Electric actuators are AUMA.
   iii) WWU prefers electric actuators.

d) SCADA and Instrumentation & Controls

i) WWU current SCADA is mostly radio with some communication by fiber optic cable. WWU noted that they prefer radio over fiber (due to cost). From review of the archived data logs, there were periods of missing data for various pump stations.
ii) WWU prefers Wikai for transmitters.
iii) Magentic flow meters at the stations visited were Krohne or Badger Meter.
iv) WWU uses Energenecs for SCADA implementation and integration.
v) WWU has different levels of control through SCADA and remote access based on login credentials.

e) Security
i) WWU prefers CTV and key fob access for security at new stations.
ii) WWU prefers that all doors be equipped with sensors tied into SCADA for entry alarms.

f) Other
i) Well pumps are larger horsepower and WWU attempts to operate them during off-peak energy use hours.
ii) Booster pumps are operated based on elevated tower levels and operate based on a demand and call sequence from SCADA. The booster pumps operate intermittently throughout a full day.
iii) WWU has mentioned that they would like to keep Well 6 as one of the emergency backup wells once the conversion to Lake Michigan water occurs. The Well 6 reservoir can be filled from the distribution system. The piping currently connecting the distribution system to reservoir is approximately 6-inch in diameter.
iv) WWU also mentioned that they would like to keep Well 8 as one of the emergency backup wells once the conversion to Lake Michigan water occurs.
v) WWU mentioned that Well 10 may not be kept as one of the emergency backup wells once the conversion to Lake Michigan water occurs.

2) Electrical:

a) Well 8
i) General
(1) Well 8 has incoming 480V electrical service from utility.
(2) Well 8 operates above ground pumps at 480V and deep well pumps at 2300V.
(3) Aboveground 480V pumps are 150 hp, with a total of two.
(4) There is a step-up transformer outdoors to step up the 480V service to 2300V for the well pumps.
(5) There is a generator receptacle located outside of the station, mounted on the exterior wall.

ii) MCC Lineup
(1) MCC is Eaton Cutler-Hammer Freedom Series 2100.
(2) The MCC includes Transient Voltage Surge Suppression (TVSS) unit.
(3) The main breaker is equipped with an Eaton power monitor.
(4) There is a generator manual transfer switch. The generator manual transfer switch switches from utility power to generator power.
(5) VFDs are located in the MCC lineup.

iii) Variable Frequency Drives (VFDs)
(1) 480V MCC runs aboveground pumps using VFDs.

(2) VFDs currently in use are Eaton Model No. SRX 9000. WWU staff is very happy with them, and understands how to maintain them.
(3) The VFDs do not appear to have a bypass, WWU staff is open to using them at new facilities due to the size and critical nature of the new equipment.
(4) Older VFDs are present, but they were not preferred. The older VFDs are Baker Hughes – Centrilift product line.

iv) SCADA Panel
(1) SCADA Panel is constructed by Starnet Technologies of Franksville, WI.
(2) SCADA panel utilizes a radio/wireless system for communication across the network.
(3) Fiber optic communication is limited to a few signals between well stations.

v) Scales
(1) Chemical weight scales are Scaletron in the building behind the well station.

vi) Portable Generator
(1) Portable generator is stored in the building behind Well 8.
(2) Portable generator is a Cummins Model No. QSM11-G4 NR3.
(3) Portable generator runs on diesel fuel.
(4) Portable generator is standby rated 318 kW (426 hp) at 1800 RPM per nameplate.
(5) Cable is heavy and is stored with generator.
(6) Generator has (2) plugs for electrical hookup on outside. The plugs have different ratings:
(a) Smaller plug is 600VAC/250VDC, 200A, 4 Pole, 3 Wire, Appleton Powertite Receptacle Style 2, Catalog No. AR20034.
(b) Larger plug is 600VAC/250VDC, 400A, 4 Pole, 3 Wire, Appleton Powertite Receptacle Style 2, Catalog No. AR40134.

b) Well 9

i) General
(1) Well 9 has incoming 480V electrical service from utility.
(2) Well 9 operates above ground pumps at 480V and deep well pumps at 2300V.
(3) Aboveground 480V pumps are 150 hp, with a total of two.
(4) There is a step-up transformer outdoors to step up the 480V service to 2300V for the well pumps.
(5) There is a generator receptacle located outside of the station, mounted on the exterior wall.
(6) Power monitors are located inside the well station, but are not in service.

ii) MCC Lineup
(1) MCC is Eaton Cutler-Hammer Freedom Series 2100.
(2) The MCC includes Transient Voltage Surge Suppression (TVSS) unit.
(3) Main breaker is equipped with an Eaton power monitor.
(4) There is a an automatic generator transfer switch in the MCC lineup. The switch is by ASCO, and it switches from utility power to generator power.
(5) VFDs are located in the MCC lineup.

iii) Variable Frequency Drives (VFDs)
(1) 480V MCC runs aboveground pumps using VFDs.
(2) VFDs currently in use are Eaton Model No. SRX 9000. WWU staff is very happy with them, and understands how to maintain them.

(3) The VFDs do not appear to have a bypass, WWU staff is open to using them at new facilities due to the size and critical nature of the new equipment..
(4) Older VFDs are present, but they were not preferred. The older VFDs are Baker Hughes – Centrilift product line.

iv) SCADA Panel
(1) SCADA Panel is constructed by Kamp/Synergy of Milwaukee, WI.
(2) SCADA panel utilizes a radio/wireless system for communication across the network.
(3) SCADA panel has an LCD HMI display.

v) Outdoor Standby Generator
(1) Generator is located outdoors behind well station near reservoir.
(2) The generator is housed in an acoustic enclosure, and the enclosure is surrounded by a walled in structure. The structure has a decorative brick facade on the outside. The inside of the structure is lined with acoustic dampening material. The access is controlled with a locked steel door, and there is a security door tamper sensor. The structure has no roof.
(3) Generator is a Cummins Model No. GTA19G2. The nameplate rating is covered up. The model no. corresponds to a 300-350 kW rated generator (rating depends on fuel compression).

c) Well 10
i) General
(1) Well 10 has a 2300V incoming electrical service from utility.
(2) There is a step-down transformer located indoors that distributes at 480V.

ii) MCC Lineup
(1) MCC is Eaton Cutler-Hammer Freedom Series 2100.
(2) The MCC includes Transient Voltage Surge Suppression (TVSS) unit.
(3) Main breaker is equipped with an Eaton power monitor.
(4) SCADA Panel is constructed in the same lineup with the MCC.

iii) SCADA Panel
(1) SCADA panel utilizes a radio/wireless system for communication across the network.

iv) Switchgear
(1) There is switchgear located outdoors. It is owned and operated by WE Energies (power utility).
(2) The switchgear is very small, and only has two sections.

d) Generators:
i) A brief discussion of diesel vs. natural gas fired generator sets was conducted. A subsequent presentation and discussion is planned during the Facilities Electrical Meeting, which will be tentatively planned for 8/24/2017. The two types of standby generators will be evaluated for the program's various applications during the discussion.

3) HVAC / Plumbing / Fire Protection:

a) Heating and Ventilation
i) Existing facilities visited contained exhaust propeller fans with intake louvers.
ii) WWU prefers gas over electric for energy source:
iii) WWU noted that unit heaters are preferred to central heating system.

iv) WWU prefers 4-20ma analog temperature sensors with a range of 20 F to 120 F tied to SCADA for control.
v) The SCADA system monitors over 5,000 points. WWU prefers detailed descriptions of alarm failures.
vi) WWU does not prefer Boilers. Boilers will not be considered for the new facilities.
vii) The winter heating temperature set point for pump and piping rooms/areas is 50 F. This is due to the temperature of the water in the pipes and process tanks.
viii) The winter heating temperature set point for chemical areas is 65 F.

b) Dehumidification systems
i) WWU noted that dehumidification units (Hi-E Dry) are utilized in the pump stations and are preferred.
ii) The existing dehumidification system at Well 10 was designed with simultaneous heating and cooling.
iii) Well 10 has a dehumidification system installed, however, WWU noted that this system is not efficient during normal conditions. It is used during very hot and humid conditions (upward of 100 F) when the portable units cannot keep up.
iv) WWU noted that the gas bills are higher in the summer, for dehumidification, than in the winter, for heating, when the dehumidification system is running.
v) WWU noted that during swing seasons the cooling coils have frozen.

c) Fire Protection
i) All chemical rooms visited have a fire suppression system containing detectors and sprinkler heads.
ii) All buildings visited (with a fire suppression system) are equipped with Fire Department Connections (FDC's) located at the entrance to the buildings. .

d) Plumbing
i) Outdoor hose bibbs are provided.

This meeting summary reflects the discussions and decisions reached at the meeting/workshop. If no objections are put forth within 5 business days from issuance, the summary will be considered to be an accurate record of the issues discussed and conclusions reached at the meeting/workshop.

GREAT WATER
ALLIANCE

Water Supply Facilities Tour: Electrical and Mechanical Meeting
SIGN-IN SHEET

July 13, 2017

No.	Name	Company	Initial
1	Kelly Zylstra	WWU	[redacted]
2	John Vick	WWU	
3	Dave Berg	WWU	
4	Nathan Hughes	Greeley and Hansen	
5	Arun Mande	Greeley and Hansen	
6	Nicole Spieles	Greeley and Hansen	
7	Michael Morris	Greeley and Hansen	
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AGENDA

Date/Time: July 13, 2017, 09:00 a.m. – 12:00 p.m.

Location: Various WWU Facilities, listed below

Attendees:

Kelly Zylstra, WWU
John Vick, WWU
Dave Berg, WWU
Nathan Hughes, GH
Arun Mande, GH
Michael Morris, GH
Nicole Spieles, GH

Time	Topic	Presenter(s)
9:00 a.m.	WWU Water Supply Facilities – Well 8 (Saylesville): o Examine Electrical Equipment o Examine HVAC Equipment o Examine Fire Detection and Suppression Systems o Examine Plumbing Systems o Examine Standby Electrical Power Equipment – Well 9 (Crestwood): 513 Crestwood Drive): o Examine Electrical Equipment o Examine HVAC Equipment o Examine Fire Detection and Suppression Systems o Examine Plumbing Systems o Examine Standby Electrical Power Equipment – Well 10 (Wolf): 1905 Wolf Road o Examine Electrical Equipment o Examine HVAC Equipment o Examine Fire Detection and Suppression Systems o Examine Plumbing Systems o Examine Standby Electrical Power Equipment	N/A
12:00 p.m.	Adjourn	

GREELEY AND HANSEN
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